EQUIPMENT ECONOMIES NUMBER

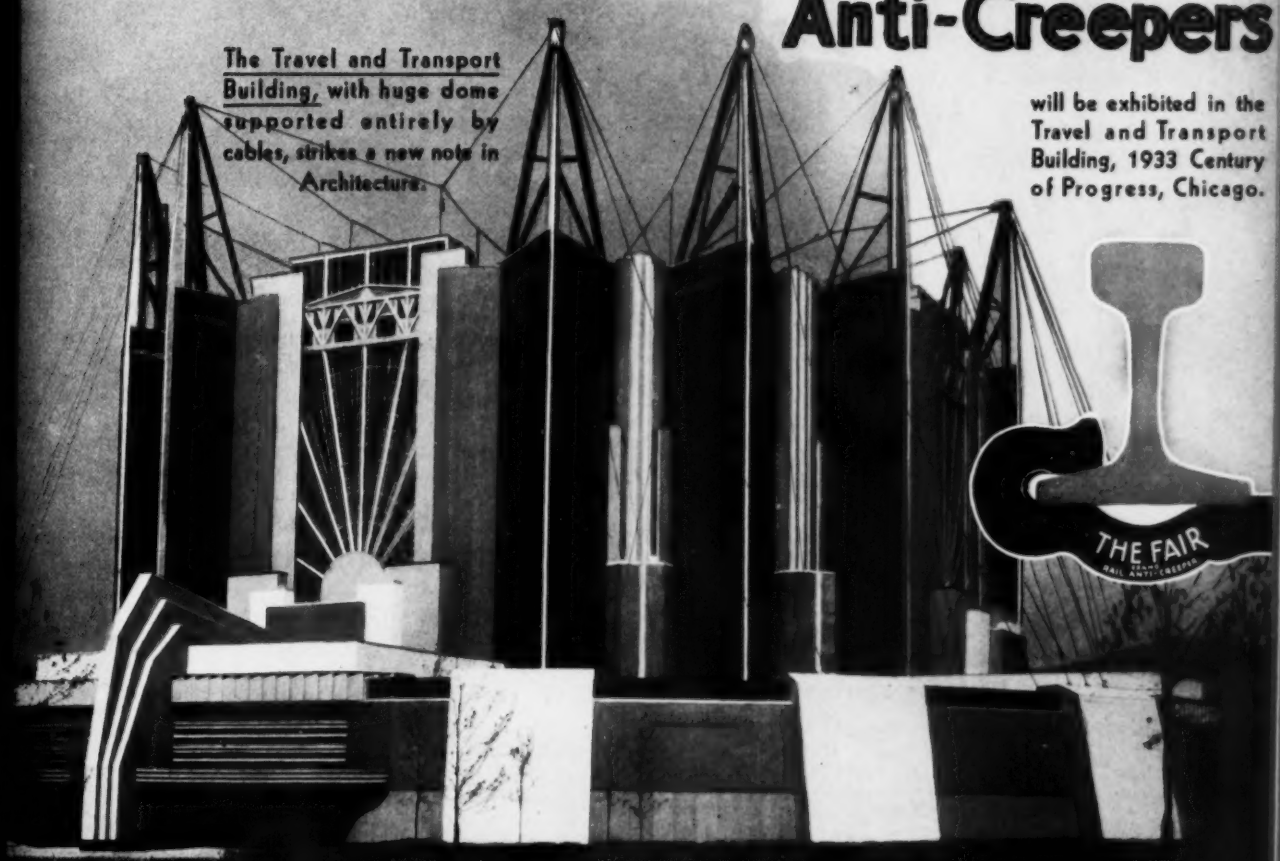
Railway Engineering and Maintenance

March, 1933

FAIR Rail Anti-Creepers

will be exhibited in the Travel and Transport Building, 1933 Century of Progress, Chicago.

The Travel and Transport Building, with huge dome supported entirely by cables, strikes a new note in Architecture.



evidence of our contributions to the progress of transportation in the ... our faith in the future, we have ... for an Exhibit at the 1933 ... Progress, Chicago.

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THE FAIR BRAND RAIL ANTI-CREEPER
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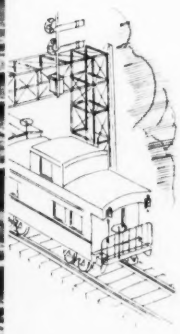

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The MOST ECONOMICAL TIE PLATE *Money Can Buy*

LUNDIE TIE PLATES
Insure Immediate as well as Continued
ECONOMIES . . . . .

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LUNDIE TIE PLATE

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Embankment protected against further washout by Armco Metal Cribbing.

ARMCO Metal Cribbing was developed to meet the need for a retaining wall that could successfully withstand the destructive forces to which this type of structure is subject.

It is particularly adaptable for grade separations, bridge wingwalls, railway embankments, loading platforms and river and harbor bank protection work.

It is a scientific development — modern and practical in every respect — designed to meet these destructive agencies as evidenced by the inspection of crib walls in service in all parts of the United States.

Check over its superiority point by point. The tremendous strength is indicated by tests far beyond the extremes of ordinary service.

Durability of the metal is beyond question. Cribbing service is usually less severe than culvert service and Armco Ingot Iron has an unequalled culvert record of 27 years to date.

Armco Metal Cribbing is made from a product of The American Rolling Mill Company, and always bears its brand.

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Low cost of installation is attracting attention of railroads at this time.

ECONOMY FEATURE No. 1 Lightness in weight (only 1/10 weight of other types of cribbing) results in low cost transportation, does not necessitate special handling equipment or skilled labor, and reduces construction time.

ECONOMY FEATURE No. 2 Advantages of metal give these savings: No breakage in handling. Does not absorb water and spall or crack. Does not pull apart or break in unstable soils. Pile or caisson sub-foundation not necessary in built-up ground. No curing period necessary.

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☐ Send more data on Armco Metal Cribbing.
I am interested in a crib wall approximately .....long by.....high.

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Title.....

Road.....

Address.....

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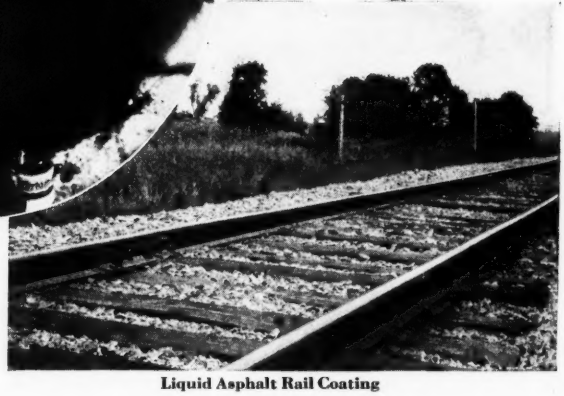
For your Spring

Applying No. 1 Korite to Bridge

Trainload of Treated Ties

Applying Liquid Coating Asphalt



Liquid Asphalt Rail Coating

Asphalt Grade Crossing

Oiled Road Bed

ASPHALTS FOR EVERY PURPOSE

maintenance...

Insure Good Maintenance with STANDARD ASPHALT PRODUCTS

No. 1 Korite

No. 1 Korite is used for hot mopping applications for waterproofing ballast deck viaducts, tunnels, foundations and roofs; for filling cracks, sealing crevices, making expansion joints and sewer pipe joints. It meets requirements for refrigerator car insulation and electrical insulation.

Grade Crossing Pavements

Stanolind Cut Back Asphalt and mineral aggregates, mixed and placed according to specifications for Asphaltic Concrete Cold Mix, provide excellent wearing and economical grade crossing pavements. Such pavements have proved satisfactory for more than 7,000 grade crossings, for station platforms, bridge decks, walks and team track paving.

Road Oil

Standard Asphalt Road Oil applied to the road-bed eliminates dust, adding to passenger comfort and reducing wear and tear on equipment. It aids in preventing disintegration of road-bed and also acts as a protection against corrosion of rails and fastenings.

Tie Treating Oil

Tie Treating Oil reduces maintenance cost by waterproofing ties, bridge timbers, piles, building and car timber.

Liquid Coating Asphalt

Liquid Coating Asphalt has many uses for moisture water proofing and corrosive protective coatings. It is used for coating roofs, steel and iron tanks, reservoirs and masonry of all types.

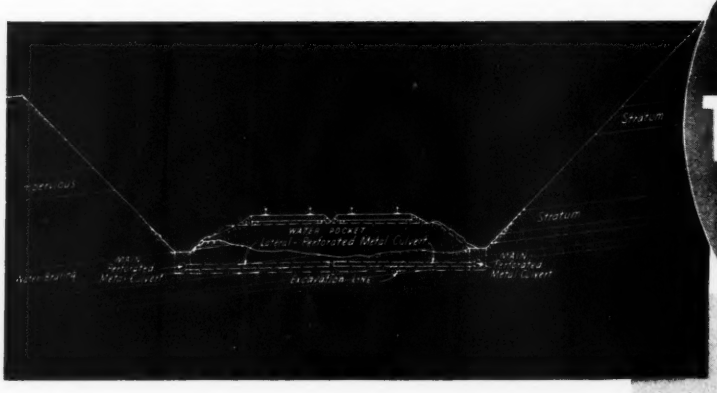
Liquid Asphalt Rail Coating

Liquid Asphalt Rail Coating acts as a preventive of corrosion to rails and bolts, increases the life of spikes, anchors and tie plates and assists in allowing the rails to expand and contract uniformly.

STANDARD OIL COMPANY
(Indiana)
910 South Michigan Avenue Chicago, Illinois
115-B

ASPHALTS FOR EVERY PURPOSE

WHERE GEOLOGICAL FORMATION SUPPLIES WATER, DRAIN WITH TONCAN IRON CULVERTS

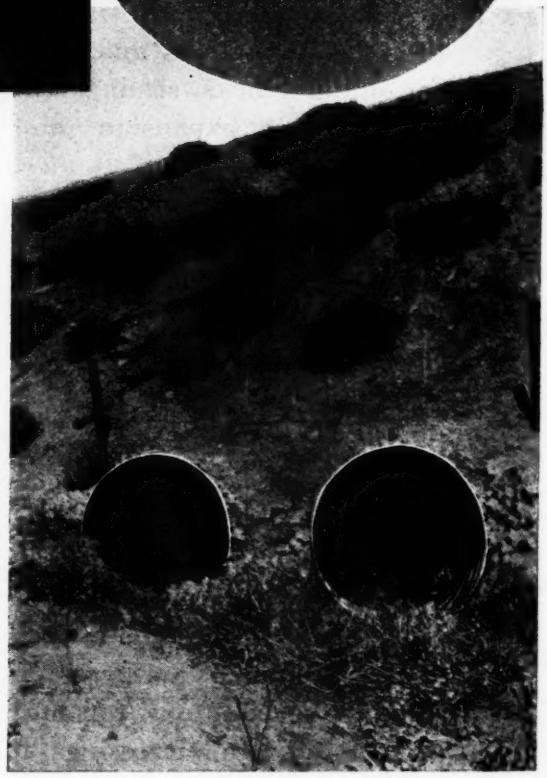


Oftentimes in the construction of a roadbed in a cut, excavation is made into or through a water bearing stratum. This condition has the serious result of water constantly seeping into the roadbed during the wet seasons. This seepage is often quite constant, and, coupled with the ditch seepage of direct rainfall water, the track is placed in a dangerous state of unstability. With such a soft roadbed, one rail may be alternately higher and lower than the opposite rail, so that traffic passing over this section will roll and pitch most disconcertingly. Ties are also badly damaged due to water soaking and to constant abrasion against the ballast upon the application of loads.

The answer to this is found in Toncan Iron Perforated Drains and Culverts installed as indicated in the drawing—perforated drains through the water collection areas at right angles to the track at required intervals, connected to culvert mains parallel to the track carrying the water away to safety.

But why Toncan Iron? Because track drainage maintenance is expensive and only in Toncan Iron will be found the desired assurance of long life in service. This fact has been proved time and again where this modern alloy of refined iron, copper and molybdenum has been tested in direct comparison with culverts only slightly lower in first cost. It is then that the true value of this remarkable metal, ranking first in rust resistance among the ferrous alloys after the stainless irons and steels, becomes strikingly apparent.

It is a privilege to assist you in planning effective drainage. Simply outline your conditions.



Installation of Toncan Iron Culverts, 72-inch diameter, 8-gauge, under Fort Worth & Denver Northern Tracks.

ENDURANCE STRENGTH

REG U S PAT OFF TONCAN IRON CULVERTS

TONCAN CULVERT MANUFACTURERS' ASSOCIATION • YOUNGSTOWN, OHIO

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● IF YOU'VE had trouble finding a paint that will give your iron and steel structures complete protection against rust and corrosion, you'll be glad to hear about the "Saucer Test."

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The "Saucer Test" will also enable you to compare the durability of Dutch Boy Red-Lead with any other paint. It will prove that this pure red-lead, no matter how exacting the conditions, will protect your property better. In a long series of tests conducted by a leading Southern railroad, the "Saucer Test" proved that pure red-lead outlasted the other paints tested by 4 to 1.

It costs nothing to make this convincing test. We will gladly send you a free "Saucer Test" kit which includes a steel testing saucer, generous sample of Dutch Boy Liquid Red-Lead, set of instructions and a practical booklet about metal paints and painting. Just send the coupon.

DUTCH BOY RED-LEAD

Dutch Boy Red-Lead is a fine, highly oxidized red-lead supplied in two forms—paste and liquid. The paste comes in natural orange red, is readily mixed to brushing consistency and can be tinted to darker colors. Dutch Boy Liquid Red-Lead (ready for the brush) is available in the natural orange red, two shades each of brown and green, and also in black.

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111 Broadway, New York; 116 Oak St., Buffalo; 900 W. 18th St., Chicago; 659 Freeman Ave., Cincinnati; 820 West Superior Ave., Cleveland; 722 Chestnut St., St. Louis; 2240 24th St., San Francisco; National-Boston Lead Co., 800 Albany St., Boston; National Lead & Oil Company of Pennsylvania, 316 Fourth Avenue, Pittsburgh; John T. Lewis & Bros. Co., Widener Building, Philadelphia.

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No. 51 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Subject: A.B.C. and A.B.P.

February 23, 1933.

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10. To determine what is the highest and largest function of the field which he serves and then to strive in every legitimate way to promote that function.

Standard Rate and Data, the leading directory of publications, lists 1777 business papers. Of these, only 240 qualify as members of the A.B.C. and less than half of this latter group are members of the A.B.P. Railway Engineering and Maintenance and its associated publications in the Simmons-Boardman group are glad to subscribe to the standards of the A.B.C. and the A.B.P. They are the only publications in the railway field that do so. These standards were drafted for your protection.

Yours sincerely,

Elmer T. Howson

ETH*JC

Editor.

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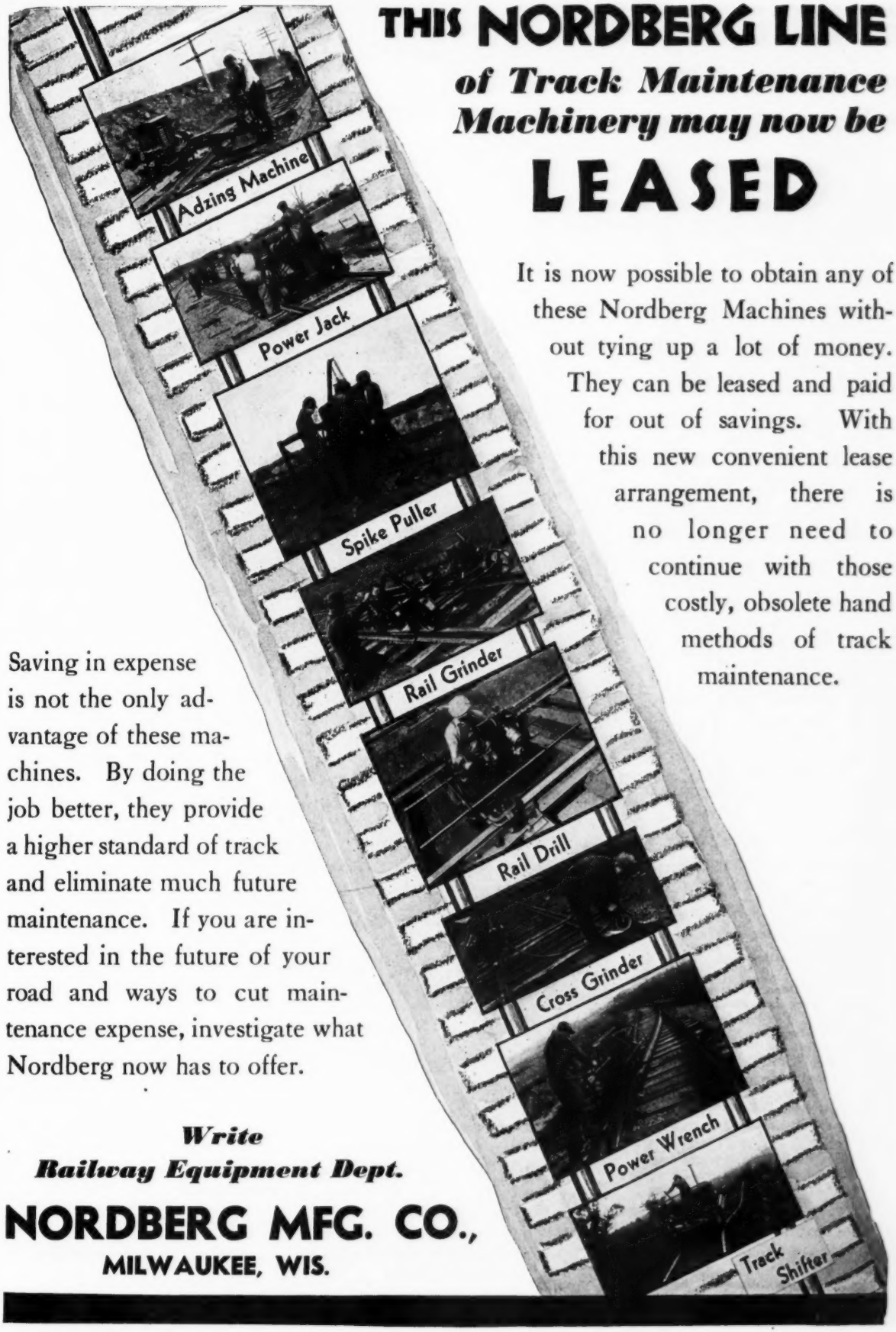
THIS NORDBERG LINE

of Track Maintenance Machinery may now be

LEASED



It is now possible to obtain any of these Nordberg Machines without tying up a lot of money. They can be leased and paid for out of savings. With this new convenient lease arrangement, there is no longer need to continue with those costly, obsolete hand methods of track maintenance.

Saving in expense is not the only advantage of these machines. By doing the job better, they provide a higher standard of track and eliminate much future maintenance. If you are interested in the future of your road and ways to cut maintenance expense, investigate what Nordberg now has to offer.

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Railway Equipment Dept.

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MILWAUKEE, WIS.

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30 Church Street

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WASHINGTON, D. C.
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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

MARCH, 1933

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RAMAPO
now offers
IMPROVED STYLE 17-B Automatic Safety Switch Stand designed especially for MAIN LINE

THIS improved design of Ramapo Patent Automatic Safety Switch Stand maintains all the essential features of Style No. 17 and of our other Automatic styles, as . . .

Positive hand throw; the target always indicates true position of switch points.

Automatic safety, a resilient connection, automatically throwing switch points to opposite position when a closed switch, set wrong, is trailed through.

Cover with removable ends for oiling and inspection.

•

IMPROVEMENTS are . . .

1. **Fewer parts; the sliding sleeve has been eliminated.**
2. **Better and more substantial fits of wearing parts, reducing lost motion to a minimum.**
3. **True alignment of switch lamp and target in either position assures proper focus for lens or reflector type lamps.**

SAFE • AUTOMATIC • POSITIVE • ECONOMICAL

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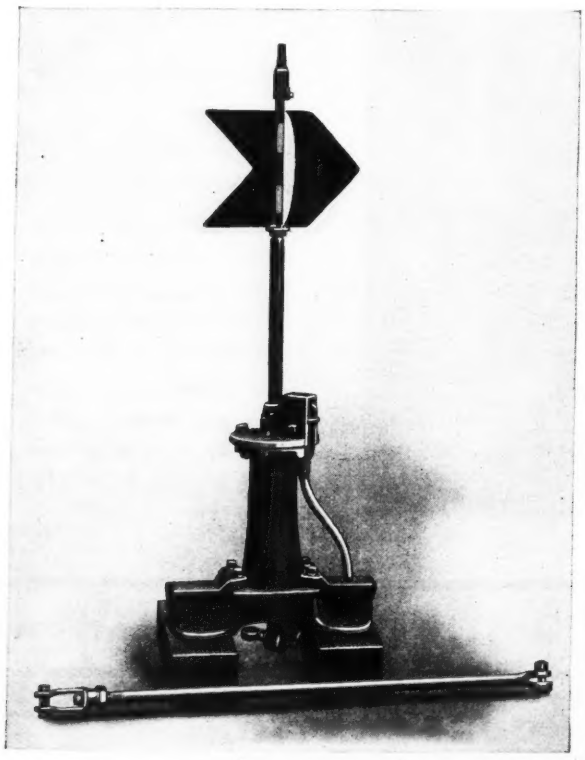
RACOR

IMPROVED STYLE 17-B RAMAPO AUTOMATIC SAFETY SWITCH STAND DESIGNED ESPECIALLY FOR MAIN LINE

How It Operates Automatically

LIKE the No. 20-B model, the MAIN LINE 17-B Ramapo stand is automatically thrown by the wheels trailing through a switch set against them. The target follows the movement and shows the new position of the switch points, and the stand is left latched, again ready for either hand or automatic operation. No damage is done to either track equipment or the switch stand.

The forward wheel of a car or locomotive passing through a closed switch closes the open point to make gage. This movement is transferred through the connecting rod to the star block on the spindle. The star block rotates against the rollers, which action compresses the springs, and when the switch points are approximately half thrown by the wheel making gage, the compressed springs complete the throw of the switch points.



Hand Operation Is Absolutely Positive

If it is desired to return the switch points to the position they were in before the train passed, the operating lever is raised and the switch points operated manually by rotating the lever to the next locking recess. When the switch is thrown by hand from one position to the other, the spindle, after the operating lever is lifted, will turn freely within the star block without revolving it, and it will be impossible to lower the operating lever into locking recess until the movement of the switch has been completed; thus making the operation by hand absolutely positive.

Like the No. 20-B model, the MAIN LINE 17-B stand has all the advantages of a rigid stand when thrown by hand. It is easy to operate, simple and positive in action.

Positive locking of the switch points in either position is assured whether the stand is thrown by hand or automatically by a train trailing the switch, but it is impossible to throw the stand by hand when locked.

SAFE · AUTOMATIC · POSITIVE · ECONOMICAL

IMPROVED STYLE 17-B RAMAPO AUTOMATIC SAFETY SWITCH STAND DESIGNED ESPECIALLY FOR MAIN LINE

The Resilient Feature Produces Safety

A resilient connection between a locked switch stand and the switch points is an important safety factor. It is a protection against fatigue of metal, crystallization and failure of connections under severe vibrational strains.

In adjusting switches there is a tendency to adjust the throw too tight so that to complete the throw of the switch stand by hand the stock rail must be rolled slightly. When this occurs the inside edge of the base of the stock rail is slightly lifted from the switch plates, and the weight of passing trains bearing it down to a firm seat on the slide plates will create very heavy vibrational strains on the switch stand connections.

With these Safety Switch Stands the connection between the spindle, when stand is locked, and the switch points is through the star block and the resilient spring-actuated rollers, which hold the star block in position. This resilient feature eliminates liability of fatigue of metal, crystallization and failures from vibrational strains.

Direct Economies

The safety feature of the MAIN LINE 17-B stand, like the No. 20-B model, is in itself justification for its widespread use. Yet over and above the many advantages derived from the safety feature, huge direct economies are realized. The average life of Ramapo Automatic Safety Switch Stands is five times greater than the average life without repairs of rigid switch stands in busy locations. While the initial cost of Ramapo Safety Switch Stands is a little more than the initial cost of ordinary types of rigid stands, from the viewpoint of life alone there is considerable economy in their use. In addition to this their use results in important labor savings, savings of excessive cost of repairs to rigid stands and to track, and the exhorbitant costs due to derailments.

Most maintenance engineers, realizing the costly results of running through switches connected with rigid switch stands, have solved this most annoying trouble by installation of Ramapo Automatic Safety Switch Stands. By this move they have increased the safety of railroad equipment and improved the regularity of service in direct proportion to the avoidance of accidents and delays.

Requirements of a Main Line Switch Stand

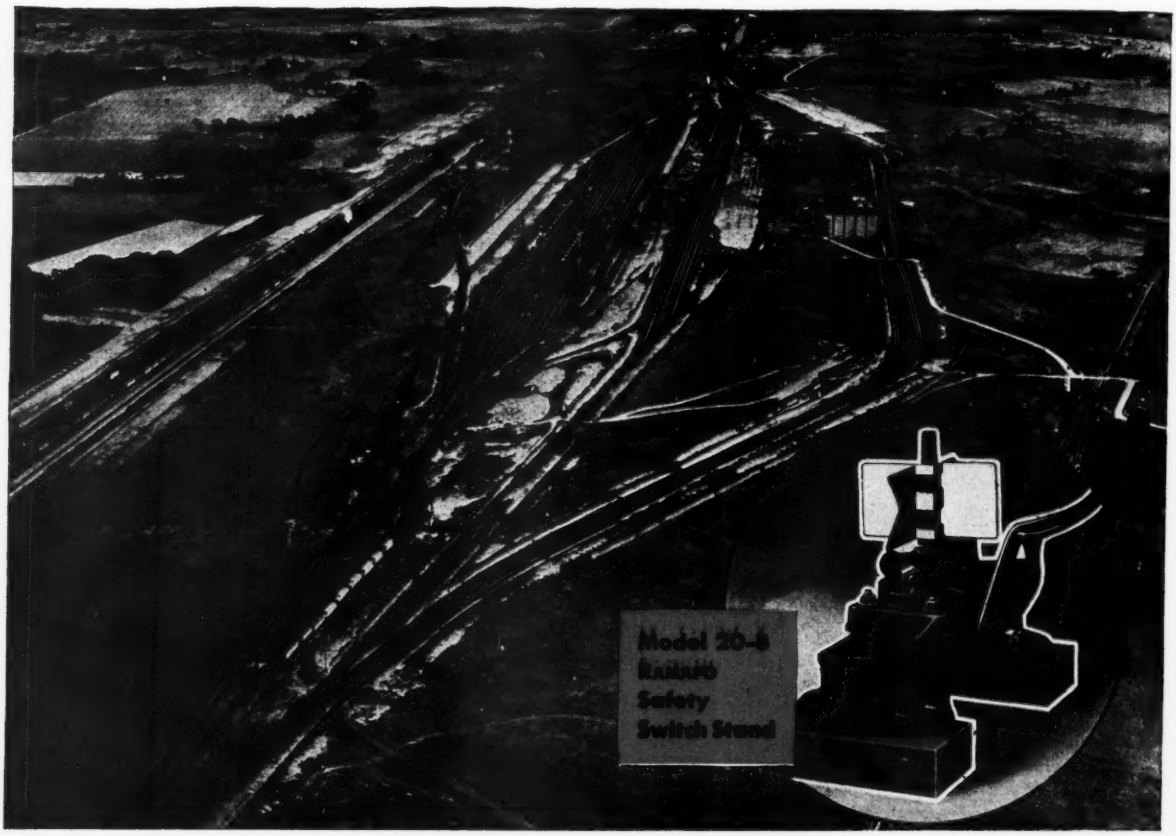
All the requirements of maintenance officials in a main line switch stand are incorporated in the improved style MAIN LINE 17-B Ramapo Automatic Safety Switch Stand, and more. It may be thrown automatically by a train trailing the switch points without interfering with the operation or without damage to the switch and or the switch or its fittings.

Accurate workmanship and sturdy design at points which are subjected to wear and strain assure satisfactory performance and long, trouble-free life. The stand is simple in construction. It permits the throwing of heavy switches with ease, because of additional leverage and minimum of friction, now provided. The stand is made of few parts which are rugged and will not easily get out of order. Lost motion is reduced to a minimum by reducing the number of parts. The working parts are of such shape and size as to permit closer fitting in the shop and facilitating interchangeability of parts.

Proper focus of target and switch lamp in either position of switch is insured.

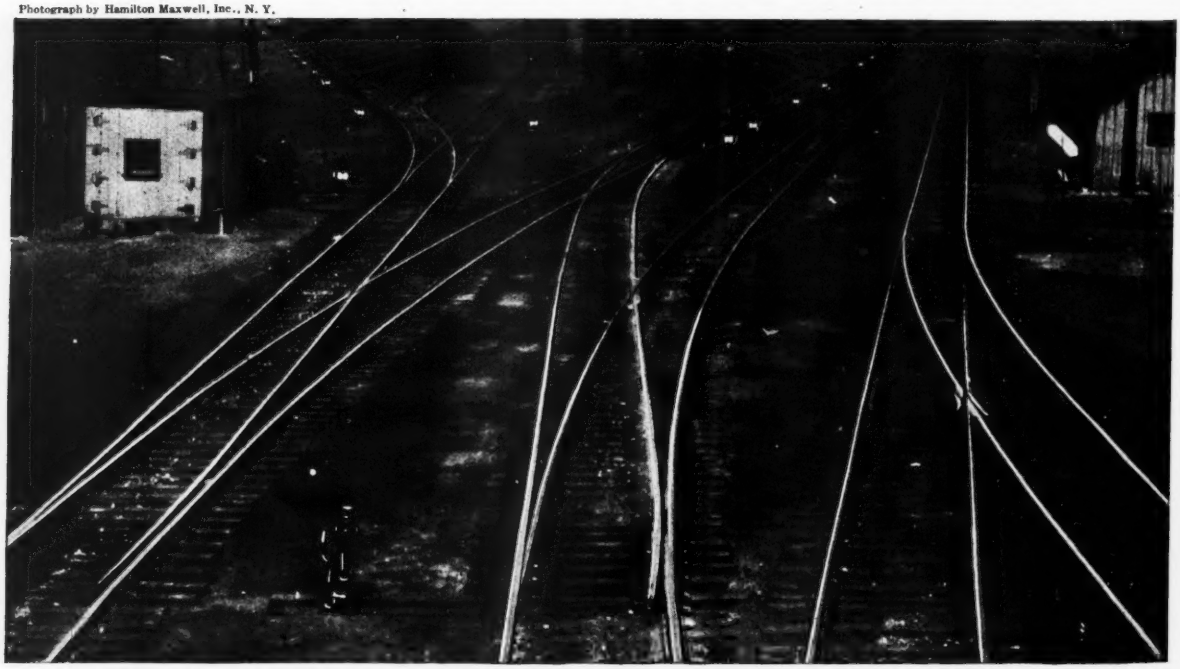
SAFE · AUTOMATIC · POSITIVE · ECONOMICAL

MORE THAN 300,000 INSTALLED



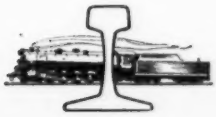
Arteries of a great system, the Selkirk Yards of the New York Central Railroad from the air. In these yards, with capacity of 20,000 cars, RAMAPO Safety Switch Stands and other Racor trackwork equipment are growing increasingly popular every year.

Photograph by Hamilton Maxwell, Inc., N. Y.



Section of ladder track in the Selkirk Yards, near Albany, New York, At every turnout a Model No. 20-B RAMAPO Safety Switch Stand is doing splendid service; this model is the most popular for yard use.

Railway Engineering and Maintenance



PARASITES?

Do the Bus and Truck Pay Their Way?

IF you were to insist on your rights as an American citizen to set up a cigar counter in the lobby of the post office or courthouse in your home town without securing a permit and paying rental therefor, you would soon run into trouble. Yet such an attempt would be no more illogical than the action of the commercial bus or truck operator who is today usurping the highways which have been built for public use and at public expense and is then objecting to the regulation of his operations and pointing to the rentals charged him in the form of gasoline taxes, etc., for the use of such facilities as "taxes."

Some Questions

This fallacy is being given wide publicity in certain quarters today—to the confusion of many people. It raises a number of questions, among which are the following:

(1) Has the individual citizen an inalienable right to the use of public property for private gain?

(2) Does the use of the highways by commercial bus and truck operators operating for profit fall in the same category with that of the pleasure car and the farmer's truck?

(3) Is the gasoline tax, as commonly collected, for the construction and maintenance of highways or for the amortization of bonds issued to finance the construction thereof a tax, as commonly understood, or is it really a form of rental paid for the use of public property?

(4) Is the rental that is being paid by commercial vehicles sufficient to make good the wear and tear resulting therefrom with reasonable provision also for interest on and amortization of the first cost? In other words, are these commercial highway vehicles paying their way?

(5) In brief, is the commercial highway vehicle a parasite on our transportation system?

These questions are of vital concern to every taxpayer today. They are of special concern to the readers of *Railway Engineering and Maintenance* who derive their livelihood from the railways and whose interests are affected adversely, therefore, by such diversion of traffic from the railways to the buses and trucks as results from public subsidies and inequalities of regulation. That this diversion is of no mean proportions is shown by studies now in progress in certain states in the Mississippi valley, wherein it has been developed that trucks are now handling freight which, if moved by rail, would yield the roads more than $15,000,000 in revenue annually in Iowa, almost $12,000,000 in Minnesota, more than $9,000,000 in Kansas, etc. Based on these figures, it is estimated that truck competition is now taking from the railways more than $500,000,000 of freight earnings annually. When it is recalled that approximately 46 per cent of the gross income of the railways is normally expended for labor, the interest of employees in arresting this diversion is evident.

An Inalienable Right

Is the privilege of using a highway, built at public expense for the purpose of conducting transportation business for private profit, the inalienable right of a citizen? Many bus and truck operators have so contended; but the United States Supreme Court has ruled otherwise. Its decisions have been far-reaching and consistent. In several cases, it has defined and upheld the rights of individual states to restrict the use of the highways in such ways as will promote the welfare of the citizens at large, including the licensing of operators, the control of loadings, the fixing of minimum rates, the levying of special charges for the use of the highways, etc. As a result, the states are rapidly tightening their control over commercial operators on the highways and curbing their inroads on other forms of organized transportation.

As a corollary to these decisions, the supreme court has drawn a sharp line of demarcation between the commercial highway operator and the driver of a pleasure car or the farmer hauling his stock or produce to town. This is a distinction that should not be lost sight of, for attempts are being made to place the railroads and others in a position of opposing all highway transportation and seeking to add to its cost, whereas the only form of highway transportation they are opposing is that which is operating for hire and endeavoring to attract traffic by reason of the subsidy which it is receiving from the public. Neither the railways nor well-informed railway employees have any quarrel with the private automobilist, all statements to the contrary notwithstanding.

As a matter of fact, the commercial highway operator is as much the enemy of the private car owner as of the railways, for in addition to breaking down the roads with his heavy loads he is more and more monopolizing the highway, crowding the automobile into the ditch and adding appreciably to the hazard of highway travel—a

hazard which has become a blot on our civilization, taking the lives every day of more than 80 persons and injuring 30 times that number in the United States alone. A steadily increasing proportion of these accidents is due to the commercial vehicle.

Pay Its Way?

Does the bus or truck pay its way? This can best be answered by comparing the income received from motor vehicles with the amounts expended on the highways provided for their use. Thus, in the years 1921 to 1930, inclusive, (except 1922, for which no information is available), motor vehicles, as a whole, paid in registration fees and gasoline taxes a total of $4,051,000,000. In the same period, there was spent on the highways by public authorities a total of $11,142,259,000. In other words, in these nine years the users of the highways paid, in all forms of support, only 36.3 per cent of the cost of the roadways provided for their use, leaving the public at large to pay nearly $2 for every $1 expended by them.

But there is still more to be said regarding the commercial user of the highways. A large proportion of the motor "taxes" are paid by private automobiles, which are operated on a non-commercial basis, and by commercial vehicles operating within city limits and not using the highways proper. Furthermore, it is not these pleasure vehicles that are fixing the standards of highway construction but the massive buses and trucks which are traveling over our roads at high speeds and pounding to pieces pavements built only a few years ago. Authorities on highway design have variously estimated the excess cost of construction to meet such loads at from $3,000 to $10,000 a mile, or, for the 145,000 miles of hard-surfaced roads in the country, a total investment of $435,000,000 to $1,450,000,000, made necessary solely to serve these modern Juggernauts of the road. Since these added expenditures are being made solely for the benefit of the trucks, it would appear only reasonable that they should pay their cost. Yet, they are not doing so. To maintain that motor traffic, as a whole, is paying its way is to deny the facts. To support such a contention regarding buses and trucks is preposterous.

Is It a Tax?

Motor interests are making much of the "taxes" which they are paying to government; among them the gasoline "tax" looms large. But is this a "tax" in the manner in which taxation is generally understood? To answer this, it is necessary only to define taxation. As commonly understood, a tax is a contribution levied for the support of government. For this purpose, the railways contributed $280,000,000 in 1932, or 8.9 cents of every dollar received. None of this went for the provision of facilities for the use of the carriers themselves, but all of it went into the public treasuries for the purpose of defraying the costs of government for the public at large. In contrast, the contributions made by motor vehicles have been applied primarily and until recently, almost exclusively, to the construction and maintenance of the facilities used by them and even then they have paid less than 40 per cent of the cost of these facilities.

Not only have these highway vehicles, and especially the commercial vehicles, failed, therefore, to contribute to the support of government, but they have actually utilized large amounts of public funds for their own purposes. While a railway provides its own right-of-way, tracks and structures and makes the expenditures from its earnings necessary for their maintenance, the commercial highway operator incurs no such expenses, but benefits from public expenditures for this purpose, made necessary in large part by his use. His so-called taxes are, therefore, in reality rentals and entirely inadequate at that. To term them taxes serves merely to befog the facts.

A Parasite

From the above statements, it is evident that the commercial vehicle is a parasite on our transportation system today. Instead of deserving sympathy, it requires curbing. It is not operating by reason of any inalienable right of citizenship. It is not paying its way but operates only by reason of public subsidy. It is a menace to other organized agencies of transportation. It is high time that the public understands these facts and that the cloud of misrepresentation be swept away. Railway employees can render no more useful service to themselves and to the roads from which they gain their livelihood than by giving the widest possible dissemination to these facts.

STRUCTURES

Inspection Is More Important Than Ever

THANKS to the widespread use of treated wood, concrete and steel in the construction and renewal programs of the railroads during the present century, they entered the present period of restricted expenditures in a much better position to curtail maintenance work than ever was possible before. Obviously, this retrenchment can not go on indefinitely, and the day is not far removed when extensive renewals must be made.

In the meantime, the responsibilities imposed upon the officers in charge of bridge and building maintenance have been greatly intensified. Failure to maintain the normal renewal and repair programs has already resulted in bringing so many structures to a condition requiring emergency attention that maintenance officers must be more alert than ever to detect not only those conditions that affect the safety of structures, but also those which, if not corrected at once, will lead to rapid and extended deterioration.

This has had the effect of altering the entire aspect of structure inspection and repairs. Although the seriousness of the situation varies markedly on different properties, and different managements approach the problem from various angles, it is a condition that demands close attention from all of them. One railway, for example, has arranged for the inspection, at intervals of 30 to 40 days, of all structures that are not out of service. This duty is performed by a corps of system bridge and building inspectors who are instructed to prepare special emergency reports daily covering each condition discovered that demands immediate correction. These re-

ports are mailed, in triplicate, to the division superintendent, the engineer maintenance of way and the chief inspector.

Items included in such reports cover all manner of defects that cannot be allowed to go uncorrected—from bad ties on a steel bridge to a sheared bolt in a coaling station hoist—from a leaning platform that encroaches on the track clearance to unsafe sheathing in a roundhouse roof. In a word, they are the detailed defects that need prompt attention by division maintenance forces, and records kept by system maintenance officers on the basis of the inspection slips insure that any failure of the division to report prompt corrections will be followed up.

This plan obviously interferes to some extent with the orderly programming of the bridge and building work of the division, but it provides an effective safeguard against the development of hazardous conditions or any lack of attention to defects that may do irreparable damage. It is to be expected that the plan outlined above is only one of many that may be devised to obtain the required results. No one system will fit every organization, but it should be evident that current conditions demand more exacting inspection and a closer follow-up than is normally required. One thing is certain —this is not a time to institute a curtailment in the inspection of bridges and other structures.

SOMETHING NEW

An Innovation in Fighting Snow Storms

ONE objection that has often been raised to the lengthening of track sections or to changes in organization that concentrate the maintenance forces in larger units, is that this measure increases the difficulty of meeting such emergencies as storms, especially the cleaning of switches during or after heavy falls of snow. It may be hard to counter this argument with respect to heavy-traffic main lines, but the method followed on a branch line during the recent heavy storm in the middle west seems to afford one answer with respect to lines of this class.

This 60-mile line is now manned by three small extra gangs, housed in bunk cars, in place of section gangs, and on the day of this storm the local freight was instructed to pick up one of these gangs and move it down the line some 20 miles. At each station along the way where the local had work to do, the extra gang got out and cleaned the switches and did such other work as the time permitted; after arriving at the point where the bunk car was set out, the gang spent the rest of the day working on the switches, driveways and platforms there.

After comparing the experience in this storm with those of other days under the old organization, the officers of the division to which this branch belongs, were satisfied that more work was accomplished than would have been done by the same number of men scattered over the line in section gangs of one or two men. Obviously an important element of any such scheme is a thorough plan of co-operation between the transportation and maintenance departments to insure that the supervisor is advised as to the conditions along the line and that the gangs are moved from place to place as necessary.

This incident is, moreover, illustrative of ingenuity on the part of the division organization. In a word, it was an experiment and it is entirely possible that some improvement or modification of the idea will be worked out in the next emergency. However, it is the kind of thing that roadmasters and supervisors should be on the alert to do.

CONSERVATION

New Materials May Give the Best Answer

EXPERIENCE has shown that such practices as the building up of rail ends and the reforming of angle bars are productive of noteworthy economies, with the result that these and other measures are being applied on substantially all railways. But because most of these practices involve the application of labor rather than material, or the re-use of old material rather than the introduction of new materials, one is easily led into the habit of assuming that the reclamation of old material is an essential feature of this procedure.

For this reason it is well to keep in mind that the objective is to conserve an exceedingly costly element of the track structure—the rail—and it does not necessarily follow that in saving the rail one must necessarily save other old material also—the joint bars, for example. This attitude is influenced by another habit of mind, the prevailing idea that new bars and bolts should be applied only to new rail when it is being laid.

The application of reformed bars and other measures to restore the rail joints have been productive of good results, but that does not mean that these practices should be employed in all cases to the exclusion of the replacement of old bars with new ones, with perhaps the application of more effective spring washers than those provided on the old bars. This, of course, will cost more money but it is possible that the difference in the result will be more than the difference in cost. At least the point is worth serious consideration.

The same observation holds true with respect to rail anchors, which, like joint bars, are normally purchased for application to new rail. The essential character of these devices has been set forth emphatically by a committee of the Roadmasters' Association, which stipulated that they must be applied to new rail without delay to minimize batter before the running surface has had a chance to become case hardened. However, as is well known, rail creeping follows no well defined law and even the most carefully studied distribution of anchors may leave certain stretches of track inadequately protected against movement that is bound to accelerate the deterioration of rail ends. It seems clear, therefore, that any program for the conservation of rail that does not embrace the application of additional anti-creepers where they are needed is incomplete. And in considering the advisability of including rail anchors in such a program it must be kept in mind that their effectiveness in minimizing joint batter is a by-product, since they were introduced originally for the purpose of eliminating other deleterious effects of rail movement.

How Far Have We Come?

An analytical study of the factors that influenced the application of power tools to maintenance of way work

THE railway industry was founded on the successful application of power to the business of transportation. Yet it was more than 80 years before power-operated tools and equipment became even a minor factor in the conduct of the work involved in the maintenance of the roadway and structures. In fact, prior to 1910 power equipment was confined almost entirely to large machines operated by steam engines or propelled by locomotives, such as steam shovels, steam ditchers, locomotive cranes, pile drivers, Lidgerwoods and spreaders, except that compressed air was employed in rail unloaders and pneumatic riveters, and that the internal combustion engine was beginning to find a place as the power unit for such equipment as concrete mixers.

Advent of the Motor Car

If any one development should be singled out as marking the beginning of the period of real progress in the substitution of power for manual labor in maintenance of way, that honor must be conferred on the introduction of the motor car during the first decade of the present century, for substantially everything that falls under the classification of power tools and equipment was introduced subsequently or greatly improved since that time. To be exact, the motor car was subjected to more than 10 years of promotional effort and mechanical improvement before the next epoch-making event occurred in the field, namely, the introduction of the pneumatic tie-tamper in 1915. That year is important, also, as marking the application of the locomotive crane to rail laying on the Lehigh Valley and of the first active sales promotion of the Three-Man rail-layer (patented about three years earlier). It is pertinent, also, to consider 1915 as establishing the time when the motor car came into its own as a unit of recognized value on all roads, regardless of their financial status. But even in that year it seemed necessary for a committee of the Roadmasters' Association to endorse the motor car as a practical appliance in a conclusion that "the motor car has been perfected so that it will now perform satisfactory work under the most severe conditions."

The slow progress in the application of power tools in their early days stands out in sharp contrast with the rapidity with which new appliances have gained wide use in the last few years. In fact, it is now hard for the practical maintenance man to realize that as recently as six years ago, the pneumatic spike puller, the power jack, the tie adzer and tractor-mounted railroad equipment were unknown, while both portable and fixed snow melters were confined to a few limited installations. The commercial development of the small

A Method That Is Going into Disuse

cranes now widely used in laying rail is a matter of less than eight years, which is the case also of the small crawler-mounted combination crane-shovel-dragline machines.

Thus, it is seen that whereas the railroads were exceedingly conservative in the adoption of earlier types of power equipment, once they became fully alive to the economies to be realized from the use of such appliances, they have been much more ready to adopt the newer tools and machines as they were placed on the market. Instead of waiting for a few of the more venturesome roads to do the "experimental" work necessary to prove that the innovations are practical, most managements have become "machine-minded" and in recent years it has required little more than a year of field demonstration of a thoroughly useful machine to secure its widespread adoption.

More Rapid Dissemination of Facts

Other influences and conditions have exerted a profound influence in promoting the more rapid adoption of modern appliances in recent years, important among which is the change in attitude toward the promulgation of facts concerning new developments. How marked this change has been is aptly illustrated with respect to the oxy-acetylene method of building up rail ends. As recently as 1920, a report on welding presented before the Roadmasters' Association referred only to the application of the process to repair work on frogs and switches, and while one speaker who participated in the discussion told of his experience in building up rail ends, he recommended the use of this process only on "exceptionally bad joints." Furthermore, the prevailing lack of interest in the subject is indicated by the fact that his remarks elicited no comment from others present. Yet at the time of the convention, one road had been building up rail ends for two years and at least two others for one year, although no report of their practices appeared in print until February, 1922. This record is all the more remarkable because manufacturers had been exhibiting acetylene welding apparatus since 1914.

Delay in the application of electric arc-welding to rail ends must be explained in another way. Although

an arc-welding outfit was shown at the exhibit of the National Railway Appliances Association at Chicago as early as 1920, and the Southern Pacific started the arc-welding of rail joints in 1923, it was not until the process was promoted actively by a contractor several years later, that any marked progress was made in its general application to rail-end work.

Some Developments Had to Wait

Similarly, the chemical process of killing weeds was established on a thoroughly reliable basis more than 25 years ago, but did not attain a position of importance until the successful application of labor-saving devices in track maintenance operations had caused railway managements to become thoroughly receptive to all measures that would be productive of savings to be effected by reductions in hand labor. As a result, the period of most intensive increase in the application of weed-killing chemicals also witnessed the introduction of weed mowers and discers and weed burners, although these appliances were not introduced until long after the merits of the chemical process had been established.

Another reason why the introduction of appliances has met with more prompt success in recent years lies in the fact that a much greater proportion of the devices offered are founded on sound principles and are more thoroughly perfected than was the case 15 or even 10 years ago.

The pioneer stage in any development is always attended by a multitude of false starts or abortive efforts. For example, an electric tamper that proved entirely unsuccessful was introduced three years before the first of the electric tampers now in general use was placed on the market. Similarly, a combination weed burner and snow melter was offered 10 years before the first successful appliance of this character was introduced. Most maintenance officers have probably forgotten the interest that was taken in motor cars advertised to operate successfully with kerosene, yet thousands of dollars were expended in the developments of carburetors designed to vaporize that fuel before the users of motor cars were willing to concede that gasoline possessed advantages that far outweighed any assumed economies inherent in the use of kerosene.

The record in the case of ballast cleaners is unique by reason of the widely varying types of machines that have been offered at prices ranging from a little more than $1,000 to as much as $100,000. Starting with a small ground-operated device in 1918, followed by the introduction of screens on gondola cars served by locomotive cranes and again by another small machine about 1925, unsuccessful efforts at the development of a large machine of a most unusual type, begun in 1922, were followed in 1927 by the perfection of a car-mounted appliance of an entirely different type that has proved thoroughly applicable in certain locations. So at present the maintenance officer has a choice of machines suitable for use under a wide range of conditions.

Half-Way Measures

For a long time, the manufacturers were confronted with a prevailing inclination of railway managements to adopt half-way measures. There was a well-defined reluctance to make the investment necessary to provide an adequate plant, as is aptly illustrated in a report on New and Experimental Track Accessories and Tools, presented before the Roadmasters' Association in 1915, which endorsed the pneumatic tamper but seemed to feel that it was better adapted to yards and terminals, "where the machines can be operated from pneumatic signal lines without the expense of additional power." This attitude also explains the delay in the application of electric and pneumatic drills and electric saws in bridge maintenance. Although tools of this character were exhibited to railway men as early as 1911, it was fully 15 years before the roads could be convinced of the economy of purchasing power plants for the operation of wood-working tools in bridge work.

Railway men were also reluctant to face squarely the fact that any epoch-making advance necessarily implies the obsolescence of equipment then in use. There is no question but that the perfection of the motor car was seriously delayed because the manufacturers were compelled for years to meet a well defined demand for "hand-car engines," partly because much of the sales effort had to be directed at the section foremen who

Track Work in the Pick and Shovel Days

bought them with their own money, and partly because the managements could not see the economy of throwing away "perfectly good" hand cars. It seems almost unbelievable today that this attitude was so pronounced that the light inspection car at one time had to meet the competition of the rubber-tired "Motor-Wheel," as the power unit for the three-wheeled speeder. It is possible, however, that some of the current policies with respect to obsolescence will seem equally short-sighted 10 years hence.

Even in the period of one generation, which embraces the entire history of power equipment in maintenance of way, obsolescence has very definitely forced its way into the picture. Obviously the motor car, the electric tamper, the pneumatic tamper and many other appliances of established usefulness have been subjected to improvements that have caused new models to supersede earlier designs. But besides these advances in design, it is necessary to consider the appliances which performed a given operation with measurable success, but which have been rendered obsolete by the introduction of machines that do a better job or a more complete one. Thus, the tie-scorer, together with the pneumatic adzing tool, were used to adze ties better and faster than it could be done by hand, but their usefulness was greatly reduced with the introduction of a machine that completes the adzing in one operation.

Hand Tamping in Rock Ballast Is Expensive

Some appliances have been the victims of changes in practice. Timber dappers and portable gaining tools, for example, performed useful service in a field that expanded rapidly following their introduction about 1918, until the rapid spread of "framing before treatment" took the work of many such machines from the field to the shop where regular wood-working equipment of the fixed type is employed.

The use of machines in maintenance work received its first real impetus during the World war when labor was scarce, and because of the powerful incentive for the application of power equipment at that time merely as a substitute for labor that was not to be had, reductions in costs of doing work were not always realized. In fact, it was some time before the managements were able to convince their supervisory officers that the investment in mechanical appliances could not be justified unless the work done with them would cost less, and it was not until late in the third decade of this century that the principles of production management were applied in the fullest measure to the administration and use of power appliances. In other words, until within the last six or eight years the power tool was employed about the same as a hand tool—to be picked up and used when such use suited the requirements of the work in hand, and then laid down again, whereas it is now considered a part of a plant investment that must be used as nearly continuously as possible with a force no larger than is absolutely necessary.

Thus, power tools have been responsible not only for the economies that accrue from their own physical capabilities, but also for the greater efficiency of the entire maintenance of way department that has been brought about by the revolution in practices and organization that followed as an inherent result of their introduction into this field. These incidental benefits were realized only in part during the "easy twenties"; it was the advent of the "hard-boiled thirties" that forced the officers of the maintenance of way departments to get out of their machines, by the improved scheduling of work, results that were formerly deemed impossible.

Winter Work in 1918, Before the Advent of the Snow Melter

In Conclusion

The history of the introduction of power appliances in maintenance work is the story of a gradual transition from extreme conservatism to genuine enthusiasm. Railway officers are not to be criticised for having proceeded slowly in the early years. Some of the appliances offered them in the early days were exceedingly crude and entirely unsound in principle, but even more pertinent was the unprecedented nature of the task of mechanizing operations scattered over thousands of miles of tracks and conducted by isolated gangs that could not be subjected to the degree of supervision that is readily provided in industrial plants. And it is not too much to say that the introduction of power tools would have proceeded slower than it did if maintenance officers had realized the magnitude of the task that confronted them. In short, they bought the machine first and then found out later how drastically they had to change their methods in order to earn a profit on the investment.

The trying days of pioneering are over; many machines are now as much standard equipment as a No. 2 shovel, and the methods of use are also being standardized rapidly. But above all, the change to power methods has been successful—more than that—power equipment has made it possible for the railroads to keep going in the face of obstacles the like of which they have never met before. How long could the railways operate trains safely if the maintenance forces they can employ with their present resources were compelled to do all of their work solely with shovels, picks, rail tongs, hand saws and drills and similar hand tools.

"The Labor Cost of Renewing Ties Amounts to About 7 or 8 Per Cent of Our Total Maintenance of Way Expense. Equipment that Would Enable Us to Reduce this Expense to, Say, 2 or 3 Per Cent of the Total Would Make a Worth-While Saving."

What of the Future?

An analysis of probable trends in equipment and its use, as it is visualized by maintenance officers under the new conditions which confront them

NOW, as never before, methods and practices in maintenance are under scrutiny and are being subjected to the most critical analysis to determine whether they should be continued, modified or superseded by others that are better adapted to present-day conditions. Work equipment, as well as the methods of using it in maintenance, has not escaped its share of this attention. In view of this and the further fact that the conditions now confronting the railways are introducing new factors which must be given consideration, and in the belief that an exchange of ideas between those who are making these studies will be helpful in arriving at their solution, a number of prominent maintenance officers were asked to express their opinions with respect to various phases of these problems. Replies showing a deep interest in the subject were received from officers on 33 roads representing an aggregate line mileage of more than 150,000.

Presented in Two Articles

From these replies two articles have been prepared. This one deals with the possibilities and limitations of work equipment, its probable future status and the extent to which it has already affected or may be expected to affect the gang organization. The second article will discuss the extent to which work equipment should (or should not) be used in view of the present widespread unemployment.

There has been frequent discussion as to whether work equipment, as developed, has met the needs of maintenance. The consensus seems to be that, in general, it has. In these discussions it has usually been recognized, however, that power machines are of recent origin and in large measure have been passing through the development stage; that while some needs have not been met, it is to be expected that this will be corrected through the ingenuity and joint effort of manufacturers and maintenance men, as soon as the demand becomes insistent enough.

But what of the future? In view of the new considerations which have arisen and which cannot be ignored, can it be expected that the present forms of equipment will continue to be satisfactory? Or will new designs or modifications of present machines be necessary to meet the requirements of tomorrow?

It seems scarcely open to question that, in the main, the equipment that has survived has given satisfaction. In the replies that were received, however, there is an evident undercurrent of thought, expressed openly in one or two instances, that heretofore there has been a tendency to be too readily satisfied with the work equipment that has been available, and to go no further, largely because it has demonstrated such marked economy as compared with manual methods, which are admittedly expensive. In other words, we are yet too close to the era of hand work and too much engrossed in developing methods to eliminate it, to consider whether still greater efficiency can be obtained by modifying or refining the design of the equipment we now have and the methods of using it.

Most of the officers who discussed this phase of the subject said frankly that the present equipment has been and still is of inestimable value to the railways, and that they have no thought of discontinuing its use. In fact, most of them feel a definite need for additional equipment or for modifications of that which is now available. Yet, it is apparent that many of them question seriously whether either the manufacturers or the railways have directed enough attention to the development of the ultimate efficiency of the equipment now available. As they view the matter, efficiency of operation and economy of use will be stressed far more in the future than they have been up to the present time.

Based on their experience in the use of work equipment and giving consideration to the factors which they believe will continue to influence this use for a number of years, three lines of development were considered necessary: (1) New machines to perform operations which are not possible with the equipment now available; (2) modifications of the present equipment to increase its efficiency or the economy of its use; and (3) modifications which will result in more satisfactory maintenance at lower cost.

Needs As Yet Unmet

Among the machines for which the need is now felt, and for which it is predicted that there will be a more insistent demand in the future, one which will remove and insert crossties was mentioned most frequently. Lem Adams, chief engineer of the Union Pacific, voiced the thought of this growing group in the statement that "we believe that a highly desirable addition to our work equipment would be a mechanical tie puller that will remove old ties from the track without disturbing the line." As Armstrong Chinn, chief engineer of the Alton, views this matter, "the labor cost of renewing ties amounts to about 7 or 8 per cent of our total maintenance of way expense. Equipment that would enable us to reduce this expense to, say, 2 or 3 per cent of this total, would make a worth-while saving."

Ballast-cleaning machines were also the subject of extended comment, in which a number of officers expressed a desire for equipment that will clean the ballast in the cribs. These comments also indicate a widespread opinion that the future development of ballast-cleaning equipment should be along the line of lighter and less expensive machines which operate independent of train operation, and that "there is also much room for improvement in the speed of doing the work, as well as in the unit cost."

Another type of equipment which has not yet been developed to the point of widespread use, but for which it was predicted that there will be a large demand in the future, is a power-driven machine for mowing the right of way. In discussing the equipment which must be developed to meet the requirements of the future, J. V. Neubert, chief engineer maintenance of way of the New York Central, spoke for those who foresee this need, when he said that "further studies must be made with a view to the development of small units, among them power machines for mowing the right of way."

Greater Speed and Efficiency Desired

Among the modifications of present equipment which must be made to meet the requirements of the future, as visualized by many maintenance engineers, are those which will give greater speed and efficiency of operation, and cheaper operation; smaller and lighter machines and tools, which will have greater flexibility, more power and improved transmission; and those which will permit a wider diversity of use.

Mr. Chinn foresees the need for "a light ditching machine that can be operated without a train crew. It should be easily removable from the track, so that an operator and a regular section gang can handle it. Some of the lighter rail cranes meet these requirements, but they handle material so slowly that the unit cost per yard is often greater than with a larger ditcher that must be handled in a work train."

Similar views were expressed by R. R. Cummins, superintendent maintenance of way of the Central of Georgia, who believes that "to meet future requirements, both new equipment and the modifications which will be necessary in present equipment must be developed to give greater speed, higher efficiency and cheaper operation. There is need for a light, sturdy machine that can be operated by two or three men to do ordinary ditching, particularly for cleaning out side ditches."

Spike-driving and spike-pulling equipment was mentioned frequently among those devices which must be modified if they are to measure up to future requirements. Typical of these comments was that of H. R. Clarke, engineer maintenance of way of the Chicago, Burlington & Quincy, who said that "improvements will be necessary in spike-driving and spike-pulling machines. Self-contained power units for these two operations have not yet been developed, which have shown any economy in operation, and there has been little, if any, improvement in the quality of the work done in the driving of spikes. With this equipment, the starting of the spikes is a very important part of the driving operation. To be successful, such a machine should be automatic."

Rail-grinding and bolt-tightening machines were also mentioned as two types that must be modified if they are to meet the demands that will be made on them in the future. The comments indicated that improvements should be made in the power units and the method of transmission.

In view of the smaller section gangs which many believe will be typical of the future, there is a growing belief that section motor cars should be made lighter than those now in use. Mr. Adams' comment on this phase of the subject was that "an item of importance is the development of light track motor cars to serve the smaller section gangs now employed, to replace the heavy cars that have been in vogue for the last ten years." He also predicted that the development of equipment for hardening rail ends to prevent flow and batter will be one of the outstanding achievements of the near future."

In discussing the need for lighter but more powerful equipment, G. A. Phillips, chief engineer of maintenance of the Lehigh Valley, said that among other features, "the present power-tamping and electric-welding equipment will have to be modified to meet the requirements of the future to the extent that the compressors and engines be made smaller in dimensions and more powerful as to capacity, to reduce both the weight and the purchase cost." Thinking along the same line, C. S. Robinson, engineer maintenance of way of the Maine Central, believes that it will be necessary for "both new equipment and improvements in present equipment to be developed in relation to the every-day jobs that the maintenance crews are forced to do, because the economies that can be effected in this field will force a demand for this type of equipment."

Maintenance Must be Simplified and Cost Reduced

That a reduction in the cost of maintaining work equipment, insurance against breakdowns and the expensive delays consequent on this form of failure and lower costs of operation are earnestly desired by maintenance officers, is evident from the large number who asserted the importance of these matters. Several of these officers said that they consider that this is a much-needed forward step. It was suggested that one means of making this advance would be for the manufacturers to standardize all parts of machines of the same class, "so far as this can be done without affecting the design or efficiency." Among the parts that were suggested for standardization were wheels, axles, transmission devices, both speed and directional, sprockets, chains and other parts which are usually purchased from other manu-

facturers and made a part of the general assembly.

It is also apparent that in the future, maintenance officers are going to insist that manufacturers strengthen those parts which fail under ordinary operation. Instances were cited where the value of otherwise efficient machines had been substantially offset by the continued breakage of certain parts, causing frequent expensive delays to the gangs they were serving. On this subject, A. N. Reece, chief engineer of the Kansas City Southern, expressed the thought of others in his statement that "while the development of new equipment is desirable, a greater need for the immediate future is the improvement of the equipment now available, particularly to reduce the delays occasioned by failures and the cost of repairs."

Similar concern was manifest with respect to the cost of operation, particularly the expense for fuel for internal combustion engines. The possibility of applying the Diesel engine, or some modification of this type, to certain types of work equipment was suggested. Mr. Clarke expressed this viewpoint in his comment that "the application of Diesel power units, if this can be done without too great an increase in weight and cost, would be of advantage, especially in view of the mounting tax on gasoline, which in some states is not being refunded."

Several officers stated, on the other hand, that the equipment now available fully meets their needs, and predicted that it would continue to do so for some time to come. Representative of the comments of this group was that of G. W. Harris, chief engineer, Atchison, Topeka & Santa Fe system, that, "I am of the opinion that the designs of equipment now on the market substantially meet present needs, and will meet the future needs for mechanical devices for the maintenance and betterment of our property."

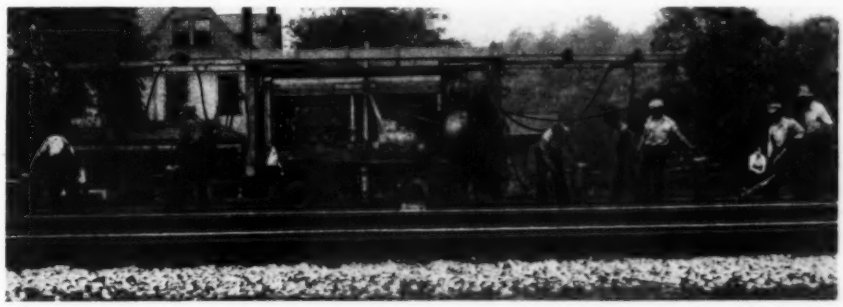
Specific Types Warrant Wider Use

Inquiry was made as to whether specific types of equipment warrant wider use than they are receiving today in applications for which they are now employed, and in other applications. There was greater unanimity on this point, most of it in the affirmative, than on any other. Substantially every type of work equipment came in for discussion, and the belief was general that more intensive as well as more extensive use should be made of many types. In fact, one or two officers implied that they thought it would be more profitable to perfect maintenance practices in the use of existing equipment with a view of extending the present applications, of finding new applications and of employing it more effectively, than to crowd the development of new devices.

With few exceptions, a wider use of welding equipment was advocated for the reconditioning of rail ends and the repair of frogs and crossings. In this connection, Mr. Phillips expressed the opinion that "a wider use should be made of power tamping and welding than is actually taking place. It seems to me that this is the time to employ welding to improve the riding qualities of the track with its contingent saving in labor by reason of the less necessity of smoothing up joints."

In common with many others, F. S. Schwinn, assistant chief engineer of the Gulf Coast Lines, is convinced that "another type of equipment which warrants wider use is the bolt tightener. This is a relatively new device which is still in the development stage, but its general use will tend toward a very much improved joint condition through uniform bolt stresses, which it is impossible to secure by manual methods."

Nearly as many indicated their belief that a much wider use of crawler-mounted excavating equipment would be of distinct advantage, particularly the convertible type which can be used as needed either as a shovel, as a dragline, as a trenching machine, or with a clamshell bucket. The comment of E. A. Craft, engineer maintenance of way of the Southern Pacific Lines, was typical of this viewpoint, in which he said that "there is a wide field for a more extended use of dragline or shovel equipment for the widening of cuts and fills, the straightening and deepening of channels and other work to improve drainage." In support of this view that wider use of this equipment is warranted, J. L. Kirby, chief engineer maintenance of way of the Seaboard Air Line, stated that "we have accomplished a great deal on the south end of our system in building embankments with draglines, which would have been impossible had not this equipment been available."



The Spike Puller Is Listed Among the Appliances that Should Be More Widely Used.

Wider Use Advocated for Nearly Every Type

In view of the large number of other devices which these engineers regarded as now being used in too limited a way, and which they asserted should be used more widely in their present applications, as well as in new applications where this is practicable, it is not possible to include specific comment on each kind of equipment. The list included joint and rail-oiling machines, power tie tampers, spike drivers, spike pullers, power wrenches, adzing machines, rail grinders, ballast-cleaning equipment, weed burners, weed mowers, discers, spreaders, paint-spraying equipment, motor trucks and tractors, while a wide variety of portable power tools for bridge and building work was mentioned.

During recent years there has been a growing conviction among maintenance officers that the work equipment of the future will tend toward off-track types. Several influences are operating to bring about this evolution, which already is in evidence. Experience has already shown that certain types of crawler-mounted equipment,

notably ditching and other excavating machines, have far greater flexibility and can be used in many situations where rail-bound equipment cannot be used. Crawler, mounted cranes have also met with favor for many kinds of work.

Another factor of importance in forcing this evolution is the mounting cost of work-train service. In recent years this has been increasing at a rate that is out of proportion to other costs of doing work. As traffic increases, delays become more serious and the loss in the productive time of the gang may be very great. In this connection, several officers called attention to the fact that executive and operating officers are just waking up to the fact that methods and devices are available which will permit them to use existing main tracks much more intensively than they are now doing, and thus avert the necessity for constructing additional main tracks. As this practice becomes more widespread, it may be expected that work trains will find less opportunity to occupy main tracks than at present.

That as a practical operation some classes of work, of which the destroying of weeds by burning or spraying with chemicals and the oiling of rails are examples, cannot be done by off-track equipment, was readily admitted. But attention was directed to the possibilities latent in the motor car as a substitute for work-train service, and it was suggested that intensive studies be made to determine the economies that can be effected in this way.

Delays Eliminated by Off-Track Units

With respect to off-track machines, J. E. Willoughby, chief engineer of the Atlantic Coast Line, expressed the opinion that "the equipment of the future will tend toward off-track design, because it will lower the cost of maintenance and relieve the equipment from the rules governing its use on the track." From the same point of view, F. R. Layng, chief engineer of the Bessemer & Lake Erie, observed that it is inevitable that "work equipment occupying the main track will either delay trains or be seriously delayed in its own operation, so that the standby loss becomes very great. Another objection is that it must always be used under conditions that require protection, which means additional, but unproductive, labor for this purpose." As viewed by J. R. Watt, engineer maintenance of way of the Louisville & Nashville, "future developments will tend toward the off-track design, since such equipment requires no protection and neither causes nor is subject to traffic delays. It is highly important not to interfere with the long freight trains that are now being operated."

On the other hand, W. P. Wiltsee, chief engineer of the Norfolk & Western, finds it "more convenient, if traffic does not interfere, to move equipment on the rails. For this reason, the question is entirely one of traffic density. If traffic is light, the work can be done more economically by on-track machines; if it is heavy, the time lost is material and the work can be done more economically by off-track machines." Opposed to this view, Bernard Blum, chief engineer of the Northern Pacific, believes that "recent experience indicates that work equipment on crawler mountings satisfactorily meets railway requirements and there is a definite trend toward such design. Equipment so mounted is free from the restraint of having to stay on a definite alignment and can work beyond the reach that is accessible from the track. The expense of clearing trains and the delays to regular traffic are avoided. Another important item which must not be disregarded is the cost of operation. It is common knowledge that the cost of doing work which involves payment to employees under the trainmen's schedules is frequently excessive and the use of off-track units promises considerable saving in this respect. While lack of travel speed reacts somewhat against its other advantages, there is a possibility of the development of high-speed tractor-type equipment in the future."

Likewise, Robert Faries, assistant chief engineer maintenance of the Pennsylvania, looks forward to "a general development of off-track designs, because they do not interfere with traffic and are not subject to delays on account of securing orders permitting their movement on tracks. But in some operations, where the advantages of on-track machines are so great in production or where the use of the track is involved in the job anyhow, there should be a development of large on-track units to secure a volume of production which is not possible with the off-track type."

J. A. Peabody, engineer of maintenance of the Chicago & North Western, also looks forward to a considerable development of off-track equipment. On this phase of the subject, he said, "I believe the future trend will be toward off-track units, so far as practicable, to avoid the loss of time and the disruption of gangs incident to removing heavy units from the track to clear trains. Heavy off-track power units for operating track tools or equipment should be self-propelled and, probably, on crawler mountings, or the present types should be modified or equipped for more expeditious and economical removal and replacement on the track."

When Does Work Equipment Become Obsolete?

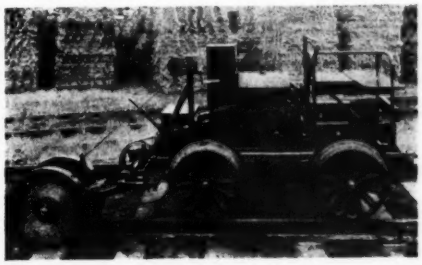
From the replies, it is evident that obsolescence has not yet been given the consideration that its importance deserves and that up to the present, the approach to this subject has been from the academic rather than the practical viewpoint. While a few units were reported to have been retired because of obsolescence, it would appear that no general practice in this respect has been developed. This was explained by the fact that few roads have yet reached the point of saturation in the types of equipment available, and that for this reason, they have been inclined to hold on to the units they have as long as their operation can be continued.

Many Motor Cars Now In Use Should Be Replaced

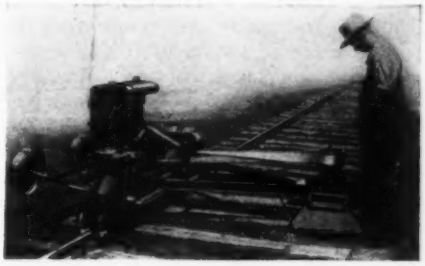
It was apparent, however, that many officers are beginning to think along practical lines with respect to obsolescence, and to question the extent to which they can justify the continued use of any unit, after there is

developed one of more modern design which can do the work more effectively or at lower cost. Because this matter has not yet been worked out on practical lines, there is some difference of opinion as to the point where obsolescence begins. Furthermore, a few are inclined to think of obsolescence in terms of physical condition rather than of relative economy.

On this point, Mr. Layng believes that "there is no doubt that much of the equipment now in use is now or soon will become obsolete by reason of the introduction of more modern and efficient units. We believe that, in general, the railways hold on to obsolete equipment longer than they should. We know that this has been our experience. A careful study will, in many cases, reveal that developments have been such as to provide more modern units that will justify replacements." Going a step further, C. H. Paris, chief engineer of the Chicago & Illinois Midland, offered this indictment: "The railway industry, as a whole, has the reputation for being ultra-conservative in adopting new ideas. From the standpoint of advancement, it would appear that we have not been active enough in replacing obsolete work equipment."



The Tie-Scorer Has Been Rendered Obsolete by the Introduction of the Tie Adzer Which Performs a More Complete Job in One Operation



Basing his opinion on past experience, Mr. Blum said that "a new machine is soon replaced by one of more efficient design and there is no reason to believe that the ultimate in work equipment has yet been attained. We must anticipate the necessity of purchasing more modern and more efficient units as time goes on. The time when an old unit should be replaced by one of more modern design is a matter of simple arithmetic. When it can be demonstrated that the modern equipment will show a saving as compared with older models, its purchase is justified. The equipment which is now considered obsolete was purchased in the first instance because it indicated substantial savings over still older models or hand methods."

Describing the practice on his road, Mr. Clarke said that "we have attempted to keep our equipment up to date by retiring the older and less efficient units, or by making improvements and modifications wherever necessary and practicable. A railway is warranted in replacing obsolete units whenever new equipment is available that will show sufficiently increased efficiency to justify the retirement of the old and the purchase of the new. In other words, the same factors enter into the decision as in a similar retirement by a manufacturer."

As one of the group which believes that obsolescence has not as yet become a matter of importance in the replacement of work equipment, Mr. Peabody observed that "since the great bulk of work equipment is comparatively modern, I do not believe that any large percentage of it is soon to become obsolete, except motor cars, although a few types of comparatively small units have already become obsolete through the development of improved devices, or because they have not demonstrated the economies that were expected of them. It is to be noted, however, that many manufacturers are doing a large amount of development work during this period of inactivity, and we may expect certain improvements to be brought out which may, to some extent, change the period of obsolescence of the present equipment.

Economical Maintenance as a Factor

Maintenance officers are a unit in their belief that work equipment should be replaced as soon as it has passed the limit of economical maintenance. They are not in full agreement, however, as to what constitutes this limit. In fact, many of them contend that it is not fixed, but varies with the size and type of the unit, its cost, the character of the work it is called on to perform and its assumed service life.

In his discussion of this phase of the management of work equipment, Mr. Willoughby said that "the criterion for the replacement of non-economical work equipment must always be the ability to perform the work more cheaply than it can be done by hand labor." Mr. Layng knows "of no formula that can be used to determine just when the limit has been reached. But, here again, I am of the opinion that the general practice is to work the equipment beyond the limit of economical maintenance."

That "the criterion for replacement will vary with different classes of equipment" is the thought of A. Montzheimer, chief engineer of the Elgin, Joliet & Eastern, who sets the limit of economical maintenance "for the less expensive machines at 50 per cent of the cost of new equipment, but for more expensive machines, repairs exceeding 50 per cent of the cost of new outfits might be made. A new machine should return the increased investment in five years."

Col. F. G. Jonah, chief engineer, St. Louis-San Francisco, however, takes the stand that "work equipment should be replaced when the cost of maintenance exceeds the carrying charge on better types." W. S. Hanley, chief engineer of the St. Louis Southwestern, also selects the criteria for the replacement of both obsolete units and those with high maintenance on the basis of relative economy, stating that "work equipment should be replaced when it is evident that new equipment will produce a reduction in the costs of work sufficient to warrant retiring the old equipment."

A similar view is held by Mr. Craft, who believes that "there is no basis to justify the use of any work equipment beyond the limit of its economical maintenance or performance, other than lack of funds or credit.

As was to have been expected, the introduction and constantly expanding use of work equipment have had a profound effect on the organization of maintenance of way forces in general and the status of some of the gangs in particular. As might have been expected with equal certainty, however, the natural reluctance of the human mind to change its habits of thought or to alter customs has exerted a strong influence to retain at least the external form of the former organization.

Despite this reluctance, certain fundamental changes have already taken place, this movement having been accelerated by the conditions which have faced the railways during the last three years. While the use of work equipment has not been the sole cause of these changes, the influence which it has exerted has been of primary importance. As an example, a number of roads have greatly extended the length of sections, a thing that would have been impracticable without the motor car.

In view of these facts and the belief, frequently expressed by maintenance officers, that we are on the threshold of a much wider and more intensive use of work equipment, it was thought that it would be of constructive interest to obtain their views on the extent to which this will affect the gang organization of the future, with respect to the size of the gangs, to greater specialization by gangs, to providing them with general or specialized power machines and tools and to the economies that have resulted or will result from these changes.

As a result of his study of this phase of the subject, Mr. Chinn concludes that these changes "will not affect our section organization. There may be some extension of section limits and changes in the methods of track inspection, but the section gang will be here for a long time to come. Neither do I think that work equipment will tend to greater specialization of gangs." A similar opinion is held by Mr. Willoughby who foresees that the more extensive use of work equipment "will lessen the number of men employed on the track and the number of gangs; it will also tend to encourage the employment of men with greater mechanical ingenuity than is possessed by common labor."

On the Lehigh Valley, Mr. Phillips states that "the introduction of work equipment has been an important factor in reducing the number of sections and in the specialization of gangs. The introduction of off-track power tampers will enable this road to make further reductions, besides securing other economies which result from work of more permanency and smoother-riding track. Purchase of certain equipment will permit us to reduce a sufficient number of sections to pay for the equipment in approximately one and one-half years." The experience of the Maine Central has also been similar, according to Mr. Robinson, who said that "during the last few years, our gangs have been reorganized to make the most of our work equipment and considerable economies have been attained."

From his own experience, as well as observation of methods in vogue on other roads, Mr. Schwinn foresees a high degree of specialization in the future. As he visualizes the developments of the next few years, "the more extensive introduction of work equipment will greatly affect the typical gang organization. It will undoubtedly reduce the size of section gangs, subject to the effect of longer sections. But more than this, it has already created, and this will continue, a demand for specialized gangs that are fitted especially to handle certain kinds of work. They will not be required to undertake general track maintenance. This type of reorganization will continue to effect further economies in maintenance costs, not only through the use of the equipment itself, but also by reason of the greater efficiency that will be attained by labor that is specially trained for particular classes of work."

A similar result is foreseen by Mr. Faries, who predicted that "the introduction and more extensive use of work equipment has, and will in the future, tend toward the organization of specialized gangs; to the performing of work in such a way that the work of the character to be done by these specialized gangs will be concentrated in long stretches, rather than, as at present, scattered over a large territory in small units of work. We believe that the more extensive use of ballast-cleaning machines, including crib cleaners, and the more extensive use of rail end welding and grinding will greatly reduce the amount of general maintenance work to be done. Road-rail inspection cars will permit the lengthening of sections, the combining of branches under a supervisor, and greatly facilitate the work of bridge inspectors and other employees of these classes."

Sufficient data are available, according to Mr. Blum, "to warrant the statement that the introduction of work equipment has affected gang organization, with respect to size and to specializing their activities. In the use of certain types, such as rail layers and the incidental tools used in laying rail, there has been a tendency to increase the size of gangs, but with the result that considerably more work is accomplished per man employed. In other instances, there has been a reduction in the number of men employed without a decrease in the total production."

Following the present trend, particularly as it has developed on his road, Mr. Craft expects that the practice in the future will be "to handle the greater part of maintenance work, particularly the laying of rail, ballasting, bridge repairs, concrete work, etc., with system gangs which will be provided with power tools and other equipment designed to perform in the most economical manner the work that is to be done. Probably, this will have the effect of reducing the number of gangs and the aggregate number of men employed to accomplish any given amount of work. Such a plan makes it necessary to prepare a detailed program of the work to be accomplished during the year or the working season. On the Southern Pacific, special gangs with complete equipment have already been developed for the handling of water-service work, steel-bridge painting and laying rail."

Special studies to develop methods of making more intensive use of work equipment have been made on the Union Pacific and to illustrate the trend in this direction, Mr. Adams reported that "during the present year we are organizing to handle all main-line tie renewals with specialized gangs. By doing this, we will reduce the normal main-line section gang from four men to three, having in mind that the specialized tie gang will do better work more economically. Further, this plan will release the regular track force for spotting and other detail maintenance. We expect to provide these gangs with power tamping tools and have developed a small tie-pulling device which we hope can be used by these gangs to good advantage. We estimate that we will save from 15 to 20 per cent in the cost of renewing ties as compared with our former practice."

It is apparent from the foregoing that, in general, maintenance officers foresee a wider and more intensive use of work equipment. It is also manifest from the comments that they will scrutinize the operation of these machines more closely and be more critical of their productive performance than they have in the past. It is equally clear that manufacturers who expect to maintain their position in the equipment field must be alert to meet the demands of the new economic era which lies ahead. There are certain trends, such as the widely expressed desire for lighter and more powerful units which will have a greater speed of operation and the need for certain types of off-track units, which cannot be ignored. It is also of as much importance to the manufacturers as it is to the railways that the subjects of obsolescence and the limit of economical repair be investigated and the practices with respect to both be developed on a sound economic basis. It is only through the joint effort and close co-operation of the manufacturers and the railways that the best solution of these problems will be found.

Machines or Hand Labor?

A resume' of opinions regarding the extent to which the use of work equipment has (or has not) helped to increase unemployment

WHAT is the effect of the use of work equipment on unemployment? This question has been prompted by suggestions from several quarters that one effective means of reducing the present widespread unemployment would be to discontinue the use of labor-saving machines and return to hand labor. While most of these suggestions have referred most directly to the construction field, particularly to public works, similar proposals have been made with reference to railway maintenance.

That this proposal is debatable is evident from the lively interest it has aroused and the wide discussion it has received. For these reasons, and in the belief that a clear statement of the facts by those most intimately acquainted with the situation in the maintenance of way field would be helpful in reaching a conclusion with respect to the railways, a questionnaire was addressed to a number of prominent officers in this department.

These men were asked to express their thought regarding the extent to which the use of work equipment had reduced employment on their lines and the extent to which they believed that their roads should use (or not use) work equipment in view of the present widespread unemployment. They were also asked what classes of work they have been able to perform in the last two years by means of work equipment which would not have been possible without it; what special advantages they have found in the use of work equipment in maintenance in these days, which do not prevail in normal times; and the extent to which such equipment is specially necessary today. Replies were received from 34 roads, representing approximately 158,000 miles of line.

Weeds Would Not Be Removed at All if Work Equipment Were Eliminated

Maintenance Officers Agree on Use of Work Equipment

Discussing the extent to which work equipment should be employed in maintenance, J. A. Peabody, engineer of maintenance of the Chicago & North Western gave it as his opinion that "it is absolutely necessary that we do everything within our power, employing work equipment where it can be used more efficiently than hand labor, to hold our costs to the minimum." The same point of view was expressed by A. N. Reece, chief engineer of the Kansas City Southern, who observed that "because of the limited funds now available for maintaining the property, it is imperative that the maximum possible results be obtained from their disbursement. This naturally calls for the use of work equipment, which in general is employed on jobs which it would be impossible to undertake if the equipment were not available. It is apparent, therefore, that the use of work equipment is actually displacing hand labor to only a limited extent."

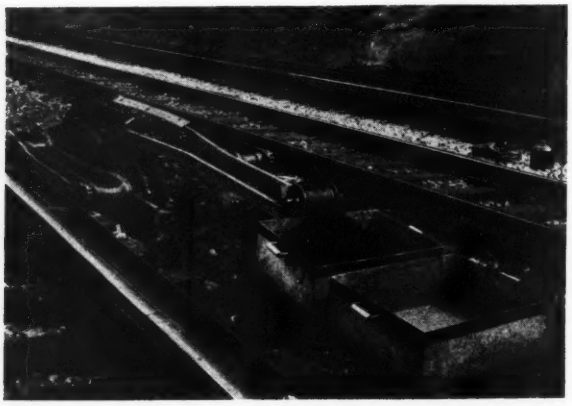
That a similar situation exists on the Southern Pacific is evidenced by the statement of E. A. Craft, engineer maintenance of way of the Texas and Louisiana lines of this road, that "while there is room for a considerable difference of opinion on the question of how far we are warranted in using labor-saving devices in these days, we have concentrated on their use wherever they could be used to advantage to effect savings as compared to manual methods. But during the last two years, very little of the work upon which this equipment has been used could have been performed if it had not been available."

Same View Point in All Sections

Indicating that maintenance officers in all sections of the country have the same view point, W. J. Backes, chief engineer of the Boston & Maine, said that "in view of the present financial situation, all work equipment that can take the place of labor which we are not able to employ, should be used to its fullest extent and it is being so used on this road at present." Likewise, J. E. Willoughby, chief engineer of the Atlantic Coast Line, believes that "an obligation rests on the maintenance of way engineer to lessen the cost of maintenance work in consequence of lessened revenues. He cannot permit that obligation to be overshadowed by humanitarian theories relative to increased employment of common labor." R. R. Cummins, superintendent maintenance of way of the Central of Georgia, added that "despite the serious and widespread unemployment throughout the country, I doubt whether the situation would be helped materially by the elimination of work equipment. It has been our own experience during the last two years that this equipment has made it possible to do work which otherwise would, of necessity, have been neglected."

Many of the replies showed clearly that maintenance officers are not insensible of the seriousness of the unemployment situation, and that they do not ignore their responsibility in the matter or refuse, so far as it lies

within their power, to do their part to relieve it. What they can do, however, is limited by the fact that a railway, like an individual, if it is to remain solvent, must keep its expenditures within its income. This attitude was well-expressed by G. A. Phillips, chief engineer maintenance of the Lehigh Valley, who said "I realize that the unemployment situation is very serious, not only with respect to the individual who is out of work, but in its national aspects as well. It seems essential, however, to make reductions at this time, for under present conditions it is rapidly becoming a question of the survival of the fittest. I want to make it plain, however,



Hand Cleaning of Ballast Is Only 10 Per Cent as Efficient as Power Methods

that we are dividing up the time, so far as possible, and are striving to keep as many persons employed as we can." The same thought was expressed by F. R. Layng, chief engineer of the Bessemer & Lake Erie, in his statement that "at present, we would hesitate to introduce work equipment that would increase unemployment, unless the economies were so great that they could not be disregarded. We lean toward spreading what work we have over our present forces rather than to displace the men we are able to employ." Typical of this view point is that of C. H. Paris, chief engineer of the Chicago & Illinois Midland, who said, "I do not believe in going backwards. To revert to ancient methods of conducting work is uncalled for. Improvement is here to stay and to be further improved. Such improvements should, however, react to the advantage of the employees through less arduous duties and a greater opportunity to enjoy life. Just where the line of demarcation is between what is economical and what is not, I do not know. The only safe answer to this problem is to say that any use of labor-saving equipment that adds to the burden of unemployment is not, in a broad sense, economical."

What Machines Should Be Eliminated

The suggestion to dispense with power equipment immediately raises some pertinent questions. What machines? How far back should we go? Should we eliminate only those that were introduced since 1920, or should we go back to 1910 or even 1900? Should the section motor car be thrown into the discard? Would it be any more logical to dispense with the spike puller, the tie tamper or the weed destroyer than to eliminate the ditcher, the side dump car or the ballast cleaner?

In making a study of the replies to discover whether there are any types of work equipment, the use of which could be dispensed with and employment increased thereby, we find that most types are being used to perform work that would not be undertaken if the equipment were not available. Going into more detail and considering ballast cleaning, weed eradication and ditching, we are faced with three items in the maintenance program that have an important influence on the rate of depreciation of the track structure as a whole. These are mentioned particularly because when done by hand, they require a large amount of labor. It was the testimony of nearly every officer that they were unable to employ a sufficient force to care for these items if done by hand and that if they were unable to use work equipment for these operations it would be necessary to neglect them.

On this point F. S. Schwinn, assistant chief engineer of the Gulf Coast Lines, stated that "regrettable as the present unemployment situation is, no one, and least of all the railways, can afford to give employment beyond bare necessity. The use of modern work equipment has replaced hand labor to a large extent, but I do not believe it has thrown labor out of work. The reason for this is that much of the work made possible by the use of such equipment would now remain undone if it were necessary to employ hand labor to accomplish it. We could not afford to clean out cut ditches with No. 2 shovels or laboriously hand-pick grass and weeds out of the ballast. It is not long since this was the general practice, but with our present need for economy, at the same time giving full consideration to our duty of providing for safety of operation, we could not justify the use of labor in such a manner. If we do not use the equipment we have available, the result will be found in clogged ditches and fouled ballast. These are only two items in a long list, and the whole subject could be elaborated indefinitely, but without profit, since these are typical."

A similar thought was expressed by one of the officers of a large system in the Middle West which is known to have made an intensive study of the economics of the use of power machines in maintenance, who said, "The limited appropriations which have been available for maintenance of way work during the last two years have emphasized the necessity for a more intensive use of work equipment wherever it can be used to offset the effect of the reduced force which we are compelled to employ. Although it may be contrary to the general opinion, it does not appear reasonable to place the responsibility for the present conditions of unemployment upon the use of machines. Rather, in our own case at least, we have used our equipment to accomplish more work with the men we are able to employ, not to displace others who could be given jobs if this equipment were not used."

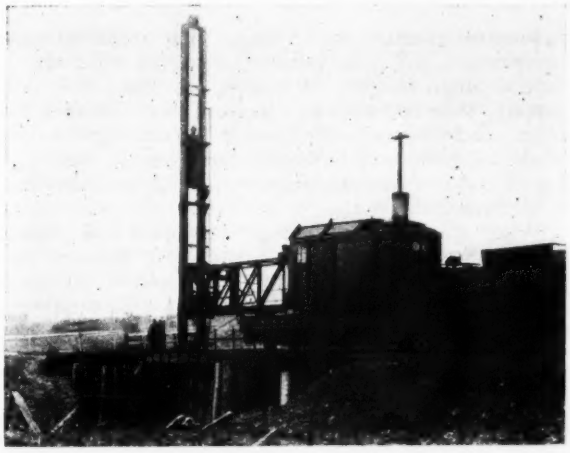
Manual Methods Exceedingly Wasteful

Despite the improvements that have been made in track construction and roadway standards, as compared to only a few years ago, constant effort must be exerted to maintain both roadway and track to these accepted standards. Taking drainage as a typical example: After a ditch has once been established, widened or deepened, effort must be applied constantly to keep it open. It is the view of maintenance officers that it is no more practicable to do this with hand labor than it was in the original construction. Ballast provides a similar example. As soon as new ballast has been applied or old ballast cleaned, the cycle of fouling begins and continues without interruption until cleaning again becomes necessary. Weed eradication is also typical of the problems that must be met in maintenance. No matter how well the track and roadbed have been cleared of weeds, the next year is sure to bring a new crop of vegetation which,

if neglected, will rapidly increase in density and add its quota to the fouling of the ballast.

Discussing this phase of the matter in the light of the proposal to return to hand methods exclusively, H. R. Clarke, engineer maintenance of way, Chicago, Burlington & Quincy, said that "the use of work equipment is justifiable and it should be used, even under present conditions, wherever this will result in a saving. It seems ridiculous to advocate a return to old-fashioned methods, using man power instead of machines at a decidedly increased cost merely to create employment. It would be much more sensible to utilize the money that is available to do all of the work possible by the most modern and efficient methods, than to do a smaller amount of work by less efficient methods. All elements considered, I think the former plan will result in fully as much actual employment as the less efficient method. This is certainly true of railway maintenance; we have only a certain amount of money to spend, and we must secure the maximum productive output from each dollar."

On the Pennsylvania, as on other roads, ballast cleaning is considered a matter of routine maintenance, and since a large amount of this work is done every year, the views of the officers of this road are of particular interest. Speaking for his road, Robert Faries, assistant chief engineer-maintenance, said, "It is necessary at present to keep the cost of maintenance to a minimum, and one way to do so is to use work equipment wherever



Obviously, the Pile Driver Could Not Be Eliminated

it shows a definite saving as compared with hand labor. Where savings are not definite, or are questionable, hand labor should be favored, to spread employment as much as possible. Our ballast-cleaning operations have been carried out practically to the full capacity of our machinery. It would have been impossible to have done 10 per cent of this work by hand." Putting Mr. Faries' statement in another way, if the Pennsylvania had cleaned the same amount of ballast by hand that it did with power machines, more than 90 per cent of the cost would have been sheer waste.

Has the Tie Tamper Reduced Employment?

More labor is devoted to the surfacing of track than to any other item of maintenance. During the last two years, a much larger proportion of the total labor employed has been engaged in surfacing than was probably ever the case before. Two methods are open to trackmen in the performance of this work—hand tamping with picks and the use of power tamping tools. It is well established that one man with a tie tamper can do as much work as four to eight men can do by hand. During the last two years, tie tampers have probably been used more widely and more intensively than any other type of work equipment except the motor car.

This being so, it would seem logical to expect that if the use of any form of work equipment has tended to add to the present unemployment, the tie tamper might be expected to do so in larger measure. That it has not is borne out by the statements of many of the officers to whom the query was addressed. Typical of these is that of an officer of one of the large systems who said, "Work equipment has been a most important factor in keeping the railways up to their present high standard physically in the face of enforced reductions in expenditures. While it is true that most of the work they have done, except the welding and grinding of rail ends, could have been performed manually, the use of the machines has made it possible to do much more work with the same amount of money. At the same time, at least this has been our experience, it has enabled them to employ an equal number of men. Surfacing is an excellent example of this. Although this is an operation that can be done by hand, it is greatly facilitated by the use of power equipment. Only through the intensive use of tie tampers have we been able to keep our track in the excellent condition it is today with the track forces we have been able to work."

In response to the query as to whether work equipment has demonstrated any advantages under present conditions that did not prevail in normal times, the testimony was practically unanimous that it has not. On the other hand, substantially every officer said that those advantages which were evident in better times are now multiplied many fold. Many of them said frankly that if they had been without power equipment to supplement the forces they were able to employ, they doubted seriously whether safety of operation could have been maintained, since a return to hand methods exclusively would have simply curtailed the total output of these forces.

While it has not been practicable to select more than a few items from the maintenance program for this discussion, the evidence that has been given could be repeated for practically every other type of power equipment, of which there is a long list. To mention them all, however, would be merely to reiterate what has already been said. Enough has been given to indicate that maintenance officers are not insensible to the seriousness of the unemployment situation. It is equally evident from the statements that have been quoted that they are not using work equipment to displace men whom they would otherwise be compelled to employ. On the contrary, they are working as many men as the money available for wages will permit, and are then employing the equipment as a supplement to increase the total output of this force, as well as to ease the burden which the use of hand labor alone entails.

In conclusion, it is apparent that maintenance officers, as reflected in the replies that were received, are practically unanimous in their belief that work equipment should be employed to the fullest extent possible now as under more normal conditions. As they view the matter, to abandon this use under present conditions would not add to employment. Rather, it would be a step backward and would create waste, since it would simply decrease the total amount of work that could be accomplished, and thus result in a more rapid depreciation in the physical condition of the railways. In other words, the number of men that can be put to work by the railways is not determined by the amount of work that should be done, but by the amount of money that can be spent for wages.

Organization Plays No Small Part in the Successful Use of Power Tools

Making Work Equipment Work*

Intelligent scheduling, skillful operation and adequate care are among the essentials to success in its use

By C. R. KNOWLES

Superintendent, Water Service and Work Equipment, Illinois Central System

THIS is a mechanical age. The advantages of machinery are recognized in all industries. The continued use of hand methods for doing work that can be performed by machine is a relic of horse-and-buggy days that can no longer be tolerated in these days of intense competition within any one industry and between industries.

Railway maintenance departments were criticized not so long ago for their lack of enterprise in adapting machine methods to their work, and it must be admitted that progress in the development and use of work equipment was slow for a time, the equipment in general use being confined largely to such special-purpose equipment as ditchers, spreaders, pile drivers and snow plows. Within the past few years, however, there has been a very rapid development of machines that are adapted to railway maintenance work on a broader scale. The progress made in the adoption of such equipment is apparent from the fact that the investment made by the Class I railroads in such appliances totals over $400,000,000.

Has Use Kept Pace with Purchase?

When we stop to consider the conditions surrounding the operation and maintenance of much of this equipment the question arises whether its application to useful work has kept pace with its development and purchase. While certain types of equipment were in use prior to 1920 and important developments have occurred during the past two years, it was during the 10-year period ending with 1930 that the greatest progress was made in the application of power units to maintenance of way work. In fact, it has been questioned whether the development has not been so rapid that railroad organizations have been unable to keep pace with the transition from manual to mechanical methods, and that the acquisition of equipment has not in some cases been greater than the ability to put it to work.

Even with the large number of machines adapted to railway maintenance work that are now available, work equipment is still in its infancy. Not only will there be further improvements in existing machines that will simplify their operation and increase their efficiency but other machines undoubtedly will be developed to do work still performed by hand. For example, there is a field for the further development of mechanical methods in tie renewals.

While there are a few persons who still protest against the adoption of work equipment, the vast majority of maintenance of way men would be unwilling to return to manual methods, for the use of equipment has made track work much more attractive. It is generally conceded also that our track is in such good condition today largely because of the intelligent use of mechanical appliances.

It is but natural that instances have arisen where the adoption and use of work equipment has not kept pace with its development and purchase. This has been due partly to conditions over which the railway officer responsible for its use has had no control, but it must be admitted that in many cases these problems have been brought about by a lack of understanding of or disregard for conditions which make for efficient operation.

The two primary objects of using work equipment are to effect a reduction in the cost and to improve the quality of the work done. The principal justification for a large investment in power tools is the saving which may be accomplished through their use. It is generally conceded that within certain limits better results can be obtained with power equipment than by hand methods. The greater economy of power tools has also been recognized. Another argument for doing work with modern equipment is that in many operations, as for example in handling rail, it is safer than hand work.

Work equipment has become so well established that railroads using it in maintenance work would not think of going back to the old hand methods, although in some cases it must be admitted that the efficiency obtained from the use of the appliances is open to question and the benefits derived from their use are exceedingly small

*Abstracted from a paper presented before the Maintenance of Way Club of Chicago.

owing to improper application and operation. This failure to consider the requirements of proper operation may be carried so far that a railroad may actually be losing money through the ownership of such equipment, because it costs money to own labor-saving appliances whether they are used or not.

In an address before the Roadmasters' Association a few years ago it was pointed out that at six per cent an investment of $450,000,000 in work equipment means an annual interest charge of $24,000,000. The repairs to these machines during the same year amounted to approximately $26,000,000, while the depreciation charges amounted to approximately $20,000,000. In all, it was estimated that the carrying charges for work equipment on the Class I railroads in 1928 approximated $70,000,000. In other words, this $70,000,000 had to be earned before any profit was realized by the railroads. We can well ask ourselves the question, "Are we doing all we can to see that our work equipment is being used in such a manner that this saving is realized?"

Must Be Kept Busy

It has been demonstrated that most of the work equipment now on the market will show a profit if properly used. But this is not enough. It must show consistent earnings in day-to-day operation on the job. This can only be accomplished by keeping it busy. The responsibility for keeping it at work rests with the supervisory force of the division, department or other organization to which it is assigned. Unfortunately, this responsibility is sometimes taken all too lightly.

In few instances have power facilities been adopted without the recommendation or approval of the supervisory force, supported by an estimate of the saving to be effected. Therefore, the man who does not do all he can to support this recommendation and make the appliances pay their way is destroying his own usefulness. Each piece of equipment represents a definite investment and, regardless of how effective it may be, it is a liability until it has been used a sufficient length of time to earn its carrying charges.

The cost of owning equipment and the earning capacity of the various units vary. While one machine may earn its carrying charges for the year in 15 days' use, another machine may require 90 days or more. The following table shows how many days a few of the commonly-used machines must be employed to pay their carrying charges, operating costs not included:

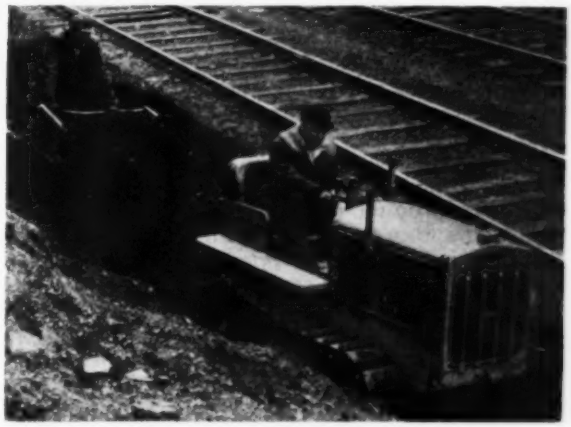
	First cost	Estimated life, years	Estimated carrying charges including interest, depreciation and maintenance	Days per year machine must work to pay carrying charges
Rail-laying crane	$6,600	10	$1,300	20
Rail-oiling machine	6,000	10	1,100	27
Tie tamper	2,600	10	500	40
Ballast discer	800	10	200	15
Mowing machine	1,000	10	300	25
Motor car	250	10	88	70

From these figures it can be determined that the cost of owning a rail-laying crane is $3.56 a day; of a rail-oiling machine, $3.00 a day; of a tie tamping outfit, $1.37 a day; or a ballast discing machine, $0.55 a day; and of a mowing machine, $0.80 a day.

In the case of the mowing machine, its effective use is limited to approximately 90 days a year, leaving 210 working days that it must remain idle. It is, therefore, essential that the mowing machine be ready for service promptly at the beginning of the mowing season and that it be kept in operation during the comparatively short period that it can be used, if the maximum return is to be obtained from the investment. At least 25 days' work is necessary to break even on the investment, which leaves only 65 days to earn any money with it. If the maximum results are to be obtained, a machine must be kept at work for the full period of its effective use.

Reasons for Limited Use

It is to be regretted that much of our work equipment, particularly the larger units representing heavy capital expenditures, is idle because of circumstances beyond our control. On the other hand certain other equipment, as for example mechanical tie tampers, may be used extensively on work other than that for which it was originally intended. The three factors which reduce



Certain Machines Can Be Employed at a Variety of Tasks

or destroy the efficiency of work equipment are inertia or opposition to its use, improper scheduling and poor operation and maintenance.

Inertia and Opposition

Direct opposition to the use of work equipment is not at all unusual, even at this late day; nor is it confined to the men who operate the equipment, for it is frequently apparent in the attitude of supervisory officers. If work equipment is to be successful, this attitude must be overcome by educational methods if possible, and by sterner measures if necessary.

Inertia, or a passive do-nothing attitude, is worse than direct opposition and is more difficult to handle. The only way in which work equipment can be utilized to its full efficiency is through an earnest endeavor by every officer to get all there is out of it.

There is nothing more important to the continued operation of power tools than properly scheduling their use. While this is, of course, true of every appliance used on a railroad it is particularly true of machines employed in seasonal work, for example, track oilers, weed-destroying equipment and rail cranes, which as a rule are used only a portion of the year.

Thus, the effective time during which weed-destroying equipment can be used is about 90 days a year. Therefore, if anything approaching the desired maximum return is to be obtained from the investment in equipment of this kind, it is essential that it should be ready for use at the beginning of the season and that it be used as consistently as possible throughout the season.

The extent to which work equipment is used and its

method of application vary widely on different roads. So, in discussing work equipment schedules it is impossible to follow a definite line of thought that will apply with equal force to all railroads. This is also true of the extent to which available equipment is utilized under present conditions.

A common source of inefficiency in the use of machinery lies in the failure to maintain definite schedules when transferring units from one division to another. The first division sometimes holds an appliance beyond the prescribed time owing to its use for work not included in the regular schedule, or for other reasons. As a result, the second division is thrown off schedule and when the equipment is received it is necessary to hold it out of service until the original plans can be revised. When equipment is to be transferred from one point to another, all concerned must be impressed with the importance of making deliveries promptly if schedules are to be maintained.

It is sometimes found that equipment requiring a train crew or pilot is delayed while waiting for the crew. This is due invariably to failure to notify the transportation department in sufficient time to permit a crew to be called when required. This is particularly true when a temporary interruption to the operation of a machine by reason of the necessity for repairs or some other condition has led to the release of the pilot or train crew. This occurs when the operator of the machine, believing it impossible to have it in service the following day does not arrange to have the crew called and finds later that the machine can be used the next day but cannot work because he has no pilot.

Special Purpose Equipment

Certain special-purpose equipment cannot be used the year around on the work for which it was designed, but a display of proper interest and ingenuity will frequently find other work for it. For example, tie tampers, either air or electric, can normally be expected to work at their principal task 200 days a year. However, they can then be utilized on such other work as breaking concrete or stone and cutting ice on tracks. Air-compressors can be used for disinfecting and cleaning cars and for operating drills and other pneumatic tools.

Another example is the weed burner, which can normally be expected to operate for about 90 days, and under favorable conditions for as long as 180 days a year. However, these weed burners are being used also for removing ice and snow during the winter months, and while this practice does not result in a marked increase in the number of days that they are used, their value as work equipment is very materially increased.

Proper Operation Essential

The expense for maintenance and the time that equipment is out of service awaiting repairs depend very largely to the manner in which it is operated. The quality of the work done and the efficiency obtained are also dependent on the character of operation.

It seems unnecessary to call attention to the importance of the proper lubrication of work equipment, because no one detail of operation bears a more direct relation to the cost of maintenance and the life of the machine. But in spite of this, nothing is more generally neglected, than the adequate lubrication of the various bearing surfaces. Although the cost of the oil, if properly used, is only a small portion of the expense of operation, its application is of the utmost importance, for lubrication is essential to satisfactory operation, and any neglect in oiling will cause excessive wear and ultimately result in trouble and expense.

To insure efficient, uninterrupted operation and minimum maintenance expense the greatest care must be exercised in choosing the operators and crews of work equipment. Men who are conscientious and capable should always be given preference. It is always best to select operators with some mechanical ability if possible, as uninterrupted operation of work equipment requires a certain amount of maintenance in the field, and many minor repairs can be made without taking the machine or equipment out of service. Indifferent operation certainly has no place in the proper use of power appliances. Whenever possible an operator should be regularly assigned to a machine and should accompany it from one point of work to another. Assigned operators take pride in their machines and will take better care of them. While the necessity for proper operation has always been realized it is of particular importance at this time when stocks of spare parts are depleted and maintenance forces have been reduced.

Abuse Should Not be Tolerated

The abuse of machines, chiefly through improper operation, is the cause of many costly delays and of a large part of the expense for repairs. Carelessness or abuse appears all too often to be taken for granted, and apparently little effort is made to fix the responsibility. In many cases the abuse of equipment is due to lack of skill on the part of an operator selected at random from the gang without any regard for his ability. In the final analysis, responsibility for the elimination of abuse of work equipment rests with the supervisory force and can be prevented only when these officers see fit to select efficient operators and give the maintenance of work equipment the same attention accorded other expenses.

Power Handling Is Safer

Many examples of such abuse of machines could be cited, but a few will suffice. In the operation of an oiling machine, an inexperienced operator allowed the engine to run dry, resulting in a badly overheated and burned engine and an expense of $300. In another case the governor was removed from the engine used to drive the sickle blades on a mowing machine and the engine was operated under hand control. Operation at exces-

sive speed caused unnecessary wear and damage, and an expense of $164. The commutators on two electric tie tamper power units working on the same job were burned out because of dirty brushes and improper adjustment, causing a total expense of about $180.

The satisfactory performance of any machine is dependent as much on the care it receives when not in use as when in actual service. While it is essential that proper care be given the machine when in use it is of equal importance that it be given similar consideration when not in service, at least to the extent that it be protected from the elements and resultant rust and decay.

If the suspension of operation is temporary or of short duration, such equipment may be stored in a tool house, freight house or other convenient building. If

Satisfactory Performance Calls for Proper Care of Equipment

such shelter is not available, tarpaulins or a temporary plank shelter should be provided and precautions taken to guard against loss or damage to loose parts of the machine or those easily removed. If machines are to be stored for a long period they should be assembled at some central point, preferably at a repair shop where they may be repaired, overhauled and stored until required for use.

Particular care is necessary with such small items as power drills, tie-tamping units, nut tighteners and similar equipment, as tools of this type are more easily damaged than the larger units. On the other hand, such machines can be cared for more readily because less space is required for their storage.

Protect Loose Parts Against Theft

Precautions should be taken to guard against theft of tools and parts, particularly in storage, although thievery frequently occurs during shipment and even on the job. If a machine is to be laid up for any length of time, parts subject to theft, such as carburetors, oil cups and similar items, should be removed and placed in safe keeping unless the equipment is housed under lock and key. When appliances are shipped in open cars, tools and such parts as are easily removed should be boxed and shipped separately. Provision should be made to protect machines on the job every night or at other times when unattended. Borrowing or "robbing" unused machines of parts to apply to active machines is sometimes necessary to avoid delay but immediate action should be taken to replace such parts in order that the machine not in use may be ready when required.

The following examples are typical of the many thefts reported: The brass fuel and oil tubing, together with other brass parts, were stolen from an air compressor while it was stored at a terminal. The tubing was found on a "moonshine" still and the other parts were located in a junk yard. Four machines equipped with storage batteries were recently shipped to a certain point. The battery from one of the machines was removed and shipped separately. The other three batteries, moving with the machinery, were stolen.

Maintenance Cannot Be Overlooked

Marked progress has been made by the railroads in providing facilities for the proper repair of work equipment. It is to be regretted, however, that the same progress is not being made in keeping it out of the shop, or in other words, in the prevention of abuses in operation which result in excessive maintenance costs and greatly reduced intervals between shoppings.

Machines are often tied up unnecessarily awaiting repairs. This is frequently due to delays in the receipt of repair parts. An adequate stock of repair parts is essential, although there is danger of accumulating excess stocks unless they are carefully and frequently checked. Stock lists of repair parts should be prepared by a competent mechanic, who is fully acquainted with the operation and maintenance of the equipment. In this connection the operator of work equipment must be alive to the necessity of using every means possible to procure repair parts in the event of a breakdown. This applies also to the local officers. Too often a machine is tied up while a requisition follows the usual routine, instead of being handled by wire or telephone.

It is not unusual for operators of power equipment to labor under the impression that their only responsibility

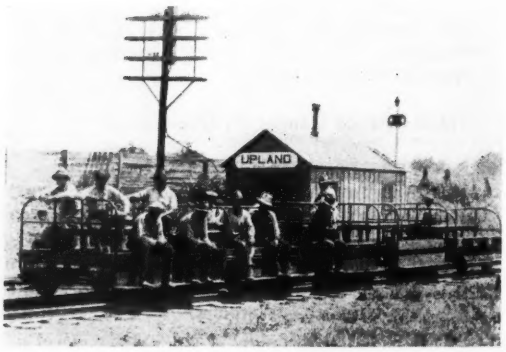
Some Tools Are Necessarily Designed for One Purpose Only

is to run the machine. They seem to think that the machine is infallible or that repairs should be handled by the builder. In many cases such appliances as motor cars are out of service because of some trivial matter; not infrequently a manufacturer's service man is summoned to adjust a spark coil or clean a spark plug.

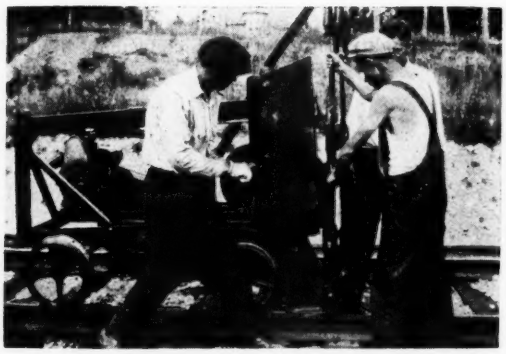
Work equipment is here to stay. We must accept that fact and realize that we must go along with it. Those who are charged with its operation and maintenance, as well as their supervisory officers, should be impressed with the amount of money invested and the importance of keeping the equipment in continuous use so that the maximum return may be obtained, not only in more effective work and better results, but in increasing the return on the money invested.

Modern Equipment Promotes

Power machines and methods of of accident than attends



A Heavy-Duty Car With Trailers Eliminates the Chance of Collisions Between Cars Operated as Independent Units

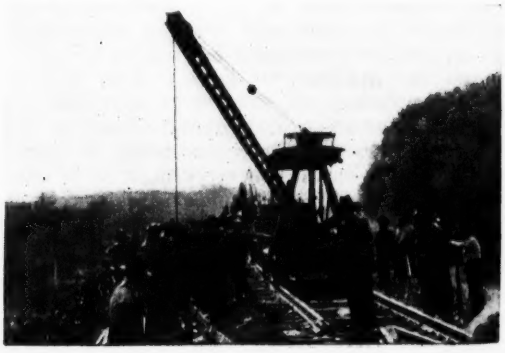


This Method of Pulling Spikes Minimizes the Hazards Encountered When a Claw Bar Slips From the Head of the Spike

The Plug Setter Is Much Safer and Easier on a Man than Driving With a Maul, Which Requires a Man to Bend Over

No Danger Here of Cut Toes From a Chance Slip of a Hand Adze—Boots and Goggles Make This Operation Entirely Safe

Compare This With a Gang of 20 or More Tong Men Struggling Up the Ballast Shoulder to Place the Rail on the Ties

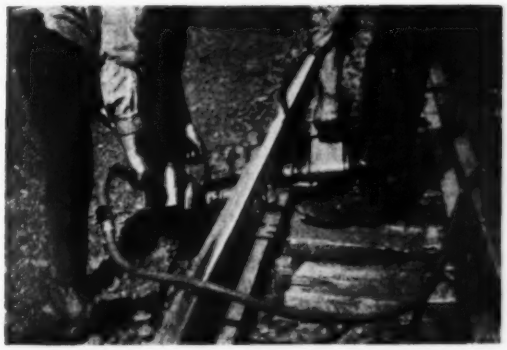


Carrying Released Rail Off a Bridge. This Is a Particularly Hazardous Job When It Is Done With Men and Tongs

*These pictures were taken from a group used as lantern slides in an illustrated lecture on Power Apparatus in Maintenance of Way Work, presented before the National Safety Council by Lem Adams, chief engineer, Union Pacific

Safety in Maintenance Work*

operation that insure less hazard
the use of hand tools



Power Wrenches Do a Quick, Accurate Job and Eliminate the Hazard of Hand Injuries from Slipping Hand Wrenches

Power Spike Drivers—No Chance of Injury Here From a Flying Spike Because of a Misdirected Blow with a Spike Maul

The Acetylene Torch Cuts the Rail Quickly and Without the Hazard of Cuts From Flying Steel or Foot Injuries

The Power Jack Provides an Economical and Safe Method of Lifting Track for Surfacing and Tie Renewal Operations

Pneumatic Tampers Have Revolutionized Track Surfacing and Have Eliminated the Hazard Attending the Use of Picks

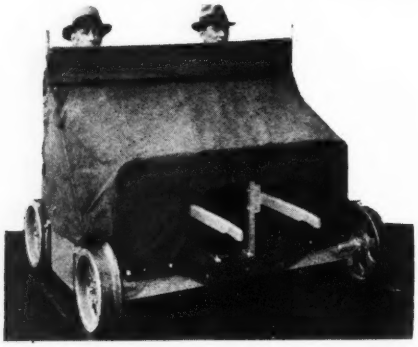
The Electric Tamper Accomplishes the Same Purpose. There Is Little Chance of Injury with the Use of Such Tools.

New and Improved Devices

Enclosure for Inspection Cars

A NEW type of windshield or storm enclosure for use with small inspection motor cars have been developed by Fairbanks, Morse & Co., Chicago. With the exception of an opening directly in front of the motor-car engine, this protector is designed to cover the entire front end of the car to a height that will protect the operator but will permit a clear view over the top.

In the illustration is shown one of these enclosures applied to a Fairbanks, Morse Model 46 motor car equipped with two seats. The windshield is drawn over an inverted U-shaped frame, the lower ends of which are pivoted over the front wheels of the car so that it can be raised to facilitate access to the seats. Side protection is afforded by flaps which reach from the U-frame to a clasp on the side of each seat near the rear. In order to permit the level of the top of the enclosure to be adjusted to the stature of the occupants, this part of the windshield is carried on a horizontal rod connected to two vertical members projecting above the top of the U-frame by T-members provided with set screws for fastening the T's at any level desired.

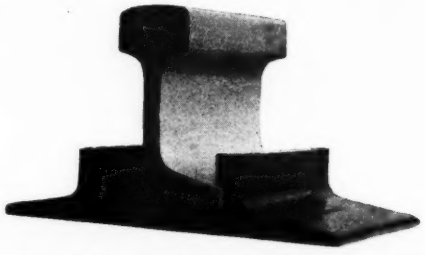


A Motor Car Equipped With One of the New Windshields

New Tie Plate Requires No Track Spikes

A TIE PLATE in which the rail is held in place by integral parts of the plate without the use of track spikes has been developed by the Woodings Forge & Tool Company, Verona, Pa. The unusual feature of this plate is that it has two shoulders extending about 1½ in. above the rail seat, which are split horizontally at opposite ends of the plate for approximately three inches of their length and at a level 3/16 in. above the top of the base of rail so that these ends can be bent inward to hold the rail in place. A special tool is used to bend these shoulders, which limits the bend and insures the proper clearance between the shoulder and the base of the rail.

These tie plates can be rolled to any desired design and dimensions. They are manufactured from mild carbon steel and may be supplied without holes for fastening to the tie with cut spikes or with holes for fastening with screw spikes or lag screws. It is said that extensive tests have shown that the shoulders of these plates can be bent about 50 per cent faster than track spikes can be driven, and that they will withstand repeated bending through the angle necessary for their service as an effective means of fastening the rail.



Illustrating the Method of Holding the Rail in Place by Bending the Shoulders of the Tie Plate Inward

Nordberg Develops Power Wrench

A NEW power track wrench for use in both maintenance work and in rail laying operations has been developed by the Nordberg Manufacturing Company, Milwaukee, Wis. This machine is mounted in a hoop frame on flanged rollers, with a guide arm extending to the opposite rail on which there is a single roller at the end.

The wrenching action is applied from the end of a wrench arm which is supported by means of coil springs from extended members of the frame. A socket is provided on each side of the wrench arm and the machine is so swiveled on the roller truck that the wrench arm can be swung from side to side to permit nuts on both sides of the rail to be reached with one setting of the machine.

The wrenches are operated by means of a chain drive from a four-horse-power, air-cooled, single-cylinder engine. The machine has a high and a low speed, and the direction of rotation of the sockets can be reversed instantly. An adjustable overload release, which can be set to give any desired torque assures that a uniform tension will be applied to all bolts. Through the use of this release, which functions through spring action instead of

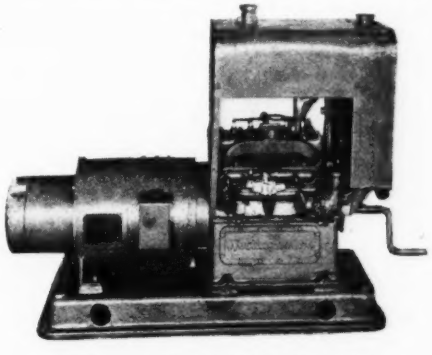
The Nordberg Power Track Wrench

by friction, no effort on the part of the operator is required to secure uniformly tightened joints.

This unit of equipment weighs approximately 550 lb. and is stid to be strictly a one-man machine. It is mounted on roller bearings and the flanged rollers are cone-shaped in design to keep the machine centered over the rail. The fact that the rollers are flanged on the inside only permits the machine to be pushed without difficulty through switches, frogs and crossings.

Gas-Electric Sets in Wide Range of Capacities

A SERIES of portable gas-electric sets for furnishing power for the operation of electrical equipment used in the construction and maintenance of tracks, structural steel bridges, signal towers, water tanks and other structures, has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These sets are available for furnishing al-



A 5-kv-a., 3 Phase, 60-Cycle Generator

ternating single-phase current of from 1 to 15 kv-a. at 120, 240 or 480 volts; alternating three-phase current at from 5 to 60 kv-a. at 120, 240 or 280 volts; and direct current of from ¾ to 50 kw. at from 32 to 250 volts.

All sets above 2 kw. and 2 kv-a. are powered with engines manufactured by the Hercules Motors Corporation, Canton, Ohio, which have 1, 2, 4 or 6 cylinders, depending on the size of the unit. All engines are equipped with force-feed lubrication to all main connecting rod and camshaft bearings and the four and six-cylinder engines of the sets up to 20-kw. and 125 kv-a. at 1,800 r.p.h are provided with cast oil pans which also act as bed-plates for the sets. The oil pumps are of the geared type, driven by the camshaft and have an adjustable regulating device. Ignition is by high tension magneto, an impulse coupling being provided where necessary, and the engines are governed by mechanical flyball governors.

These sets are equipped with standard Westinghouse a-c. or d-c. generators, and all sets up to 25 kv-a. have rotating type armatures. All automatic direct-current sets are cranked through the generator by means of a 32-volt storage battery, an arrangement being made to trickle charge the battery during the operating period. All exciters are designed for 32-volt operation and are used also as the cranking motor for starting the engine, being operated from the storage battery.

The alternating current single-phase sets weigh from 825 to 3,500 lb., the alternating current three-phase sets from 960 to 8,900 lb., and the direct current sets from 410 to 7,600 lb.

A Stainless Steel Tape-Rule

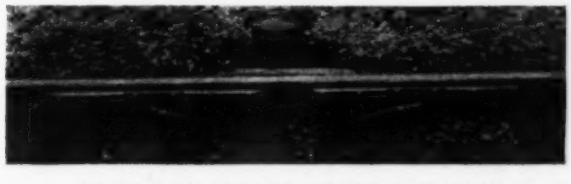
THE Lufkin Rule Company, Saginaw, Mich., has brought out a new six-foot tape-rule which is similar to this company's Crescent tape-rule except that it is made entirely of stainless steel. This tape, which is

Crescent All-Stainless Tape Rule

known as the all-stainless Crescent No. S-696, is graduated in inches and sixteenths for general use, while for engineers the upper edge may be marked in feet, tenths and hundredths, with the lower edge in inches and sixteenths. When marked in this manner, the tape is known as No. S-696-D.

Rail Lubricator Improved

DURING the past year the Maintenance Equipment Company, Chicago, has made a number of important improvements in its Type MB Meco rail and flange lubricator, the purpose of which has been to adapt it more readily to variations in train speeds, changes in temperature and other differing conditions encountered on the more than 60 railroads on which these lubricators are now in use. Among the various changes, the strength of the piston spring has been increased to permit quicker action in handling heavy lubricants in freezing temperatures, particularly where train speeds are high. Pressure-gun lubrication for parts subject to wear has also been incorporated in the design, and the adjusting set



The Improved Meco Rail and Flange Lubricator

screws now provided are made of rust-proof metal.

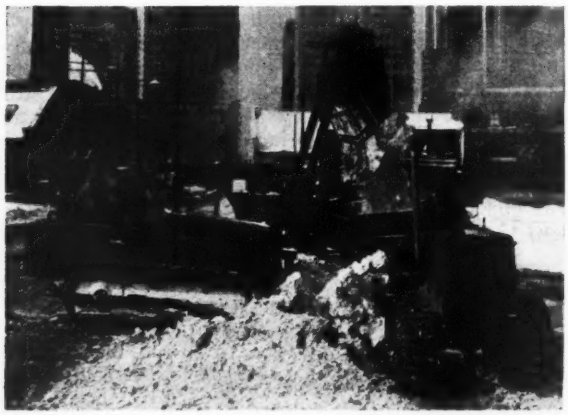
Further experience during the past two years indicates that these lubricators may be spaced so that the total length of the high rails in the curved territory to be protected between them is about a mile. Local conditions of traffic, curvature and grade vary this distance. In a number of cases lubricators are spaced five miles and more apart, lubricating a mile of high rail in the territory between them. These lubricators have also been adapted to the lubrication of guard rails.

It is said that a number of grease manufacturers have succeeded in compounding paste lubricants of the proper consistency for year-around service in Meco lubricators, and that the use of such compounds eliminates the former necessity of changing lubricants with changes of season. This claim is supported by both laboratory and service tests throughout a temperature range of from —10 deg. F. to +110 deg. F.

Use Caterpillar Tractors to Fight Snow

DURING the blizzard which covered a considerable portion of the country with a heavy blanket of snow on February 6 and 7, Caterpillar tractors were used extensively by railroads in the Chicago area for keeping platforms, drives, streets and tracks open and free of snow. One of the largest users of these tractors was the Illinois Central which, with four tractors in operation, kepts its facilities in operation so successfully that there was little or no delay in the spotting of cars or in the movement of street vehicles to and from platforms, freight houses and team tracks. The storm in question descended on Chicago late on February 6 and continued unabated throughout the night and until about 10 a. m. of the next day. During this time nearly 13 in. of snow fell and was blown into drifts by a wind ranging in velocity from 20 to 42 m.p.h.

The Illinois Central was confronted with the task of keeping open the drives and platforms in the South Water Street district, which contains approximately four miles of team tracks, with about 237,000 sq. fet. of team-track driveways, 158,000 sq. ft. of streets and 120,000 sq. ft. of driveways along freight-house platforms. Here the road employed two Model 25 Caterpillar tractors, one equipped with a bulldozer and the other with a combination Anthony front-end loader and bulldozer, and a Holt two-ton tractor. The bulldozer was attached to the tractor in such a way as to cast the snow to one side and the procedure in opening streets was for the tractor to make one trip in each direction piling the snow along the sides of the cut thus made. In opening team-track driveways, the procedure was the same, the snow being piled in such a way as to allow trucks ready access to the doors of cars.



At the South Water Street District of the Illinois Central Showing the Tractor Equipped With the Anthony Loader Loading Snow into the Trailer Trucks

Along the tailboard side of freight-house platforms the snow was collected in piles between the doors and in some cases where the snow was exceptionally deep it was necessary to limit service to every second door along the platform and to pile the snow in between. In one case a tractor was used to clear a drift from a platform track beside a fruit warehouse to allow a loaded car to be spotted.

By the foregoing methods the drives and streets were quickly made passable and the tractors were then turned to the task of disposing of the snow. This was done by either loading the snow in coal cars for disposal by the railroad or by hauling it to a dumping ground in the immediate vicinity. In the first case the snow was loaded in the cars directly by the tractor equipped with the front-end loader, which loaded about a yard of snow a minute, while in the latter case it was loaded by the same machine into a string of side-dump trailer trucks which were hauled by a third tractor.

A fourth Model 25 Caterpillar tractor equipped with a bulldozer was employed at the Central station of the Illinois Central at Twelfth street to keep the drives open along the mail and baggage platforms and to and from the passenger station. Occasionally the tractors were utilized to free trucks that had become stuck in the drifts.

Introduces Series of Light Motor Cars

THE Northwestern Motor Company, Eau Claire, Wis., has introduced a series of three light motor cars which are designed for a wide variety of services and all of which can be handled on and off the track by one man. These three cars, which supplement the Type 532 light all-service car described in the issue of March, 1932, page 201, are a signal and patrol car, designated as Type 533; a light all-section car, known as Type 534; and a one-man inspection car, known as Type 535.

The Type 535 One-Man Inspection Car

The Type 533 car weighs 475 lb., has a drawbar pull of 90 lb., seats two men readily and has a lifting weight of 125 lb. This car is said to operate effectively on heavy grades and against strong winds, and to go from 55 to 65 miles on a gallon of gasoline.

The Type 534 car is a full-size section car weighing less than 500 lb., will seat eight men and develops a drawbar pull of 110 lb. It is said that this car will handle additional trailers loaded with men or materials. It has two tool trays 68 in. long, 15 in. wide and 6½ in. deep.

The Type 535 motor car has been designed especially to provide a light and powerful car for one-man opera-

tion. When constructed of alloy steel, this car weighs 450 lb., although the weight is reduced to 390 lb. when constructed of aluminum alloy. It develops a drawbar pull of 90 lb. and has a lifting weight of 95 lb. Space for tools and materials is afforded by two full-size tool trays, while full-width safety rails are provided at both ends of the car.

All the cars in this series are equipped with Type Z Briggs & Stratton four-cycle, air-cooled aluminum engines equipped with flywheel magneto ignition and manually adjustable governors. The engines weigh 95 lb. complete. All mechanical parts of the cars in this series, such as wheels, axles and bearings are interchangeable. The frames are constructed of electrically-welded seamless alloy steel tubing, while the standard safety railings, which form a part of the seat frames, are made from one-inch seamless steel tubing, also electrically welded. The seats are suspended on springs and the seat frames are removable as complete units by removing four pins.

All cars in the series are equipped with aluminum-center wheels having replaceable steel tires. All axles are of nickel alloy steel 1½ in. in diameter. Timken tapered roller bearings are standard equipment on axles and transmissions, the bearings being mounted in special aluminus alloy housings.

Tractor-Mounted Generators and Compressors

THE Cleveland Tractor Company, Cleveland, Ohio, is now offering to the railways its line of crawler tractors, known as Cletracs, equipped with welding and grinding generators, air compressors, snow plows, rotary brooms, crane booms, bulldozers, winches and other auxiliary equipment. The standard models of these tractors, numbered 15, 25, 35, 55 and 80, vary essentially in size and power, but the model which is adapted most directly to maintenance of way work is the No. 25, which has a maximum draw bar horsepower of 26.79, an overall length of 105 in., a width of 57⅜ in., a height at radiator cap of 55¼ in. and weighs 7,000 lb.

The "25" is powered by a six-cylinder, 3¾-in. by 4¼-in., four-cycle, water-cooled engine and is provided with selective type transmission, affording speeds of 1.95, 2.8 and 4 m. p. h. The normal speed in reverse is 1.83 m. p. h. The tracks of the "25" are made up of 58 unitary drop forged steel track shoes, 12 in. wide, with interchangeable grousers to suit conditions. The total tractive surface of both treads is 1,506 sq. in. A special feature of all Cletrac models is the steering arrangement, that is effected through a planetary compensating differential, actuated by the engine, which provides power to both tracks when turning.

A Model 25 Cletrac Equipped with a General Electric Generator

Any suitable make or size of generator or compressor can be furnished with the tractor. For example, the illustrations show a General Electric 300-ampere welding generator mounted on one side of a Model 25 tractor, with the control apparatus mounted on the opposite side. Other tractors have been equipped with other makes of generators for both welding and grinding work.

One air compressor which has been adapted for tractor mounting is the Davey air-cooled type, which is built in a considerable range of sizes, although it is recommended that compressors having displacements of 160 cu. ft. and 320 cu. ft. of air per minute be used on the Cletrac 25 and Cletrac 35, respectively. Two units of the larger compressor can be mounted on and operated by the Cletrac 80.

Both the generator and air compressor equipment furnished with the tractors are driven through multiple V-belts from a power take-off at the rear of the tractor, and both types of units are readily demountable from the tractor and are interchangeable on the carrying plates provided. The mounting of either generators or air compressor equipment on the Cletrac 25 increases its overall width from 57⅜ in. to 72¾ in.

A New Inspection Car

AN inspection motor car embodying a number of features that are new in motor-car design has been announced by Fairmont Railway Motors, Inc., Fairmont, Minn. This car, which is known as Model M9, has a total weight of 425 lb., with many of its parts made of aluminum. The frame is constructed of aluminum alloy and is equipped with rail skids of the perforated aircraft-girder type.

The car is powered by a 5 to 8-hp. reversible Fairmont engine, which is mounted on springs to absorb shocks due to power impulses. Battery ignition is standard, although a magneto may be supplied as extra equipment. The cooling system embodies an aluminum water hopper surmounted by a steam condenser which returns the water for repeated us. The car is driven by a Fairmont endless cord belt and the four-wheel self-centering brakes are provided with steel-faced aluminum shoes.

The New Fairmont M9 Inspection Car

This car has a wheelbase of 32 in. The wheels are 14 in. in diameter and have demountable manganese steel tires. Stub axles are used at the front end of the car so

that the front wheels are free to turn independently in opposite directions when the car is being turned. A total of 10 Timken bearings are used in the axle boxes and belt control.

I-R Air-Operated Sump Pump

THE Ingersoll-Rand Company, New York, has developed a portable, air-operated sump pump which is adapted to a wide range of pumping operations arising in construction and maintenance work on the railways, including pumping from sumps, trenches, manholes, cassions, cofferdams, tanks, etc. This pump, which will handle clear or dirty water, and even moderately heavy sludge, consists of an open-impeller type centrifugal pump driven by a "multi-vane" type air-motor, both units being inclosed in a one-piece housing. The pump, which is designated Size 25, weighs only 50 lb., and is, therefore, readily moved from place to place.

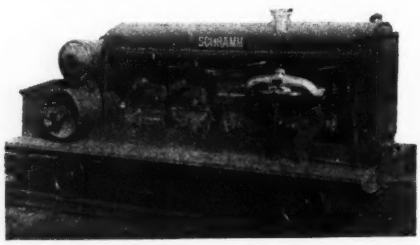
The New I-R, Air-Operated Portable Sump Pump

The unit is intended for lifts of 10 to 40 ft. with air pressures of 70 to 90 lb., but it is said that it will give satisfactory results under widely varying conditions of both head and air pressure. At 80 lb. pressure, the capacity of the pump ranges from 170 gal. per min. with a 10-ft. lift through 20 ft. of 2½-in hose, to 125 gal. per min. with a 40-ft. lift through 50 ft. of 2½-in. hose. The pump is self-priming as it has no suction lift, and it is only required that its lower part be kept submerged sufficient to cover the inlet screen. The materials used in the manufacture of the units are adapted to ordinary pumping conditions, but special parts of bronze, stainless steel, etc., can be furnished.

Schramm Compressors With Rail-Car Mountings

SCHRAMM, Inc., West Chester, Pa., is now making its standard compressors of 120, 180, 240 and 360 cu. ft. piston displacement per minute available on a self-propelled rail car with transverse wheels for removing the unit from the track. This mounting is provided with an all-metal housing with sliding removable doors, an all-metal running board and a large tool box mounted on the rear end. Another feature is a heavy duty self-alining clutch that permits the engines to be started independently of the compressor.

These compressors are all powered with four-cylinder, four-cycle Buda engines ranging in speed from 780 to 800 r.p.m. The 120 and 180 cu. ft. sizes have two-cylinder compressors, while four-cylinder compressors are used in the 240 and 360-cu. ft. units. The compressors may also be had with a motor drive and with or without the self-propelling feature. A lifting bale may be provided if desired.

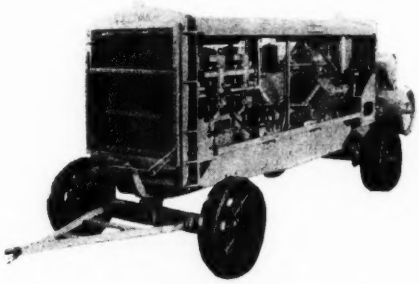


The Schramm 360-Cu. Ft. Compressor With the Rail-Car Mounting

A Two-Stage Compressor

A PORTABLE COMPRESSOR having a capacity of 505 cu ft. of free air per minute has been placed on the market by the Sullivan Machinery Company, Chicago. This compressor, which is known as Model WK-314, is mounted on rubber-tired steel wheels, which may be replaced with timber skids if desired. In general, the design follows that common to all the compressors manufactured by this company, the principal point of difference being the introduction of two-stage compression with an intercooler between stages.

A four-cylinder V-type compressor is used, in which the two low pressure cylinders are located in a block on one side of the crankshaft and the two high pressure cylinders in another block on the opposite side. The intake or low-pressure cylinders are 11½ in. in diameter, the discharge or high pressure cylinders are 6½ in. in diameter and the stroke is 5½ in. The compressor carries a working pressure of 100 lb. per sq. in. and a maximum working pressure of 110 lb. per sq. in. The engine and compressor operate at a speed of 800 r.p.m. The cooling system for the compressor and intercooler is separate from that of the engine, a sectional tubular radiator being located at the rear of the mounting.



The Sullivan WK-314 Portable V-Type Two-Stage Compressor

Power is furnished by a six-cylinder, 6-in. by 7-in., 124-hp., Climax gasoline engine, equipped with an electric starter. The entire assembly is mounted in a fabricated all-steel frame, and, with the exception of the air receiver and gasoline tank is enclosed in a heavy sheet-steel housing. When mounted on skids, the unit has an overall length of 17 ft., an overall width of 6 ft. and a height of 7 ft. Its weight is about 14,000 lb.

Winter Scene on the Grand Trunk Western

What's the Answer?

Have you a question you would like to have someone answer?

Can you answer any of the questions listed in the box?

Thickness of Shims

What is the maximum thickness of shims that should be permitted in heaved track? If the heaving is greater than this amount, how should the track be surfaced ?

One Inch Should Be the Limit

By W. R. GARRETT

Yard Foreman, Chicago, Burlington & Quincy, Pacific Junction, Iowa

No main track, and this is particularly true of high-speed tracks, should ever be shimmed more than 1 in. and then only when it is double spiked and securely braced. If the heaving is greater than 1 in., then the ties directly under the heave should be adzed and the rail lowered to the permissible depth, which is determined by the depth which can be reached without unduly weakening the tie. If the shimming that is required is so excessive that this method is impracticable, the track should be brought to surface by picking out the ballast and raising the track each way from the heaved spot. This is undesirable if it can be avoided, however, because the strip that is thus raised will need resurfacing as the frost leaves in the spring.

Because of the heavy motive power which is now being operated, and the high speeds that are being maintained, rails should not be lifted very high above the ties on shims. If this is done, there is no assurance that the track will remain safe when it is constantly receiving thrusts from heavy equipment.

Heaving Nearly Eliminated on High-Speed Tracks

By J. C. PATTERSON

Chief Engineer, Maintenance of Way, Erie, Cleveland, Ohio

Cleaner ballast and liberal installations of drains in road crossings and other wet points in the roadbed have practically eliminated heaving in our high-speed heavy-duty main tracks. It still exists to some extent on branch lines having inferior ballast and drainage. Heaved track can usually be detected before it becomes serious and action can be taken to correct the conditions by proper drainage. Wherever practicable, preventive measures are preferable to temporary correction by the use of shims.

Where necessary to employ shims, we use flat rectangular pieces of hardwood 4½ in. wide extending 2 in. beyond the base of the rail, bored with two diagonally opposite ¾-in. holes for spiking, in thicknesses of ¼ in., ½ in., 1 in. and 1½ in., the latter being the maximum. Shims should never be used without first removing the tie plate. If considered desirable, the plate can then be spiked in a leaning position outside of and under the head of the rail to act as a rail brace.

If 1½-in. shims are not sufficient, it is advisable either to dig out the old ballast, replace it with proper material and resurface the track, or place a slow order. Usually the latter course is advisable, as a change in temperature may alter the condition in a short time and considerable labor may be saved by the slow order. Under no conditions should the track be resurfaced on either side of a heaved spot, since this will result in uneven surface as soon as the frost disappears.

To Be Answered in May

1. *What are the advantages, if any, of applying anti-creepers through main-line turnouts? Through yard turnouts? How should they be placed?*

2. *What is the best method of removing stringers from a trestle that has been filled? What precautions should be observed? Should the caps be removed also? Why?*

3. *Does the practice of "digging in" ties when making renewals affect the riding qualities of the track? Does it have a detrimental effect on the roadbed? If so, how can these effects be minimized?*

4. *What fluctuations are permissible in the head against which a centrifugal pump must work? What are the effects of wider variations?*

5. *When cleaning ballast, under what conditions does the advantage of cleaning the cribs justify the cost of doing this?*

6. *What methods should be employed when applying prepared roofing to eliminate the tendency to wrinkle? Are these methods the same in the winter as in the summer?*

7. *What disposition should be made of the material obtained from cleaning out side ditches through cuts in the spring? Of the material left when installing permanent drains in cuts? What methods should be employed?*

8. *What are the most common forms of deterioration in small stone and concrete box culverts? How should they be repaired?*

Thick Shims Are Not Safe

By H. E. HERRINGTON
Section Foreman, Minneapolis & St. Louis, Jordan, Minn.

Shims used to support the rail where track has heaved should not exceed 2 in. in thickness under any class of traffic. If a greater thickness becomes necessary, a slow order should be put out, since it is impossible to insure the stability of the rails under high speed, by means of shims, spikes and rail braces where shims of more than 2 in. are used. Usually a certain amount of snow and ice works under the shims. This tends to loosen both the shims and spikes, and is quite likely to result in spread track. The proper method of bringing the rails to surface in these cases is to insert planks of the proper thickness between the rail and the tie, but even when this is done, I consider a slow order necessary.

Shims Should Not Exceed 1¼ In. in Thickness

By ALEX ANTYMNIUK
Section Foreman, Canadian National, Riverhurst, Sask.

Shims should never exceed 1¾ in. in thickness. Where trains are frequent or are operated at high speed, the shims should be at least 24 in. long and 7 in. wide, with two extra holes bored to permit spiking them securely to the tie with standard shim spikes. When it is necessary to shim more than this, a hardwood plank of the same width and proper thickness should be used. Planks for this purpose should be at least 7 ft. long, with holes bored to fit the base of rail. In addition to the spikes that hold the rail, the plank should be spiked to the tie with boat spikes. If necessary to do additional shimming, one shim of the required thickness should be used on top of the plank. The use of several thin shims to build up to the proper thickness should never be permitted.

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Concrete in Alkali Soils

What means, if any, can be employed to eliminate or minimize the deterioration of concrete in alkali waters or soils ?

Several Precautions Are Necessary

By A. C. IRWIN
Manager Railways Bureau, Portland Cement Association, Chicago

More than 10 years ago the Portland Cement Association began an investigation to obtain data bearing on the effect of alkali waters and soils on concrete. Test cylinders were set in alkali soils and waters in the northwestern section of the United States and Southwestern Canada. These cylinders, 10 in. in diameter and 24 in. long, were set upright, one half being in the soil. A wide range of mixes and consistencies were included in these tests, as were various integral admixtures and surface coatings. At the same time a parallel research program was carried out in the laboratory. After 10 years' exposure to what are believed to be the most severe alkali conditions to be found in this country, inspection of the test cylinders resulted in the following conclusions:

1. An intimate relation was found between the 28-day compressive strength of plastic, workable concretes and their ability to withstand sulphate attack; the stronger the concrete, the higher its resistance to sulphates.

2. Mixes that were too dry, and, therefore, honeycombed, and mixes of high water ratios, and, therefore, of low strength, offered poor resistance to sulphate attack.

3. Plastic mixes having water ratios of 5 gal. or less to a sack of cement and having durable aggregate, offered very high resistance to alkali attack, ranging from 90 to 100 per cent perfect after 10 years of exposure. These percentages in other cylinders ranged down to zero after a few years; in general, in proportion to the water ratio, those having high water ratios being entirely disintegrated after four years' exposure at Montrose, Colo.

4. Admixtures of waterproofing and alkali-proofing compounds gave, in general, poorer results than similar concrete without these compounds.

5. Boiled linseed oil and a proprietary compound composed largely of linseed oil, when used as surface coatings, were found to be effective in preventing sulphate attack. The linseed oil was applied hot in three coats; the compound in two coats. Asphalt, tar and pitch gave favorable results. In many instances, however, these latter materials did not adhere sufficiently to the concrete to exclude the sulphates, apparently because it was impracticable to obtain a coating free from pin holes.

From these conclusions and others derived from the laboratory research, the means to be employed to eliminate or minimize deterioration of concrete in alkali soils or waters can be deduced. They are:

1. Do not use more than 5 gal. (total) of water to a bag of cement.

2. Make certain that the aggregates are, in themselves, resistant to alkali attack. Crushed flint and sandstone should be avoided.

3. The mix should be *plastic*. Over-wet or over-dry mixes should not be used.

4. The concrete should be given a relatively long period of moist curing, followed by an extended period of aging in the air before exposure to alkali soil. These treatments are important.

5. Where it is impracticable to age the concrete in the air after curing and before it is subjected to contact with the alkali soil, coatings of boiled linseed oil, as described, on surface-dry concrete are recommended. Coatings of asphalt, tar or pitch, if applied to give a complete covering free from pin holes, should be effective in preventing deterioration.

High Density Most Important Factor

By J. J. LaBAT
Assistant Bridge and Building Foreman, Missouri Pacific, Wynne, Ark.

Very extensive tests to determine the effect of alkali soils and waters on concrete have been under way at Medicine Lake, S. D., for the last 12 years. The waters of Medicine lake have the highest concentration of alkalis to be found in any of the waters in America. They are particularly high in magnesium sulphate, but contain other alkali salts as well. This site was chosen because magnesium sulphate seems to be the chief trouble maker for concrete.

As was expected, low grade concrete did not last very long. This was true of low grade concrete, whether this was the result of a high water ratio, an unusually low water ratio or a low cement content. As the density of the concrete was increased, the resistance to alkali attack was increased proportionately and that having the highest density has given excellent results.

In general, I would say that all portland cement concretes are subject to deterioration, not only when in contact with alkali soils and waters, but from other causes as well, unless they have a relatively high density. Alternate wetting and drying of concrete exposed to alkali soils and waters is more detrimental than continuous immersion.

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Guard-Rail Gage

What is guard-rail gage? How was it established? How is it measured ?

It Is Independent of Track Gage

By J. C. LESLEY
Assistant Engineer, Southern Pacific, Tucson, Ariz.

Guard-rail gage is the fixed distance between the gage side of the frog and the flange side of the guard rail. This distance is 4 ft. 6¾ in. and is independent of the gage of the running rails. It was established by the fact that for many years prior to 1908 the M. C. B. rules specified that the greatest distance between the gage of one wheel and the back of the opposite one, known as the check gage, should be 4 ft. 6¾ in. With the practically universal use of a flangeway of 1¾ in., this allowed a passageway, known as the gage of the guard and wing rails, or the guard face gage, of 4 ft. 5 in. The latest M. C. B. rules specify 4 ft. 5 3/32 in. as the minimum distance between the backs of wheels, which gives only 3/32 in. total clearance for this passageway.

Guard-rail gage is measured from the gage line of the frog, ⅝ in. below the top of rail, to the flange side of the guard rail, and should never be measured in any other manner. A common error among foremen when setting guard rails is to measure an opening of 1¾ in. from the running rail. This is correct only when the track gage is exactly 4 ft. 8½ in. When done on sharp curves, or in turnouts, which require the widening of the gage, the effect of this method is to create an obstruction to the free passage of the wheels. They will then tend to pull the guard rail inward, and the running rail with it, since they are generally clamped together; to mount the guard rail; or to tear it out, particularly if clamps are not used. The effect of diminishing the guard-rail gage is to cause the wheel flanges to strike the frog point when making a facing point movement.

Standard Guard Rail Gage Is 4 ft. 6¾ In.

By W. R. GARRETT
Yard Foreman, Chicago, Burlington & Quincy, Pacific Junction, Iowa

Standard guard-rail gage is 4 ft. 6¾ in., measured from the gage side of the frog point to the wearing side of the guard rail, regardless of the gage of the track. A proposed standard which was submitted to the A. R. E. A. last year for discussion and which will be presented for adoption at the March convention this year will, if approved, permit this gage to be made ⅛ in. less, or 4 ft. 6⅝ in., but never more than 4 ft. 6¾ in.

Guard-rail gage was established to conform to the "check gage" of the wheels, which is the distance from the gage line of one wheel to the back of its companion. Under the standard adopted by the A. R. A. in 1930, this is 4 ft. 6 15/32 in. This leaves a clearance between the gage side of the running rails and the gage point of the wheels of 21/64 in. If the guard-rail gage is 4 ft. 6¾ in., there will be a clearance of 3/64 in. between the face of the guard rail and back of the wheel, and a similar clearance between the wing rail of the frog and the back of the opposite wheel, assuming full unworn flanges in each case.

Modern track gages have a guard-rail gaging block which makes it easy to determine the exact gage when setting guard rails.

[Answers to this question were also received from J. L. Brightwell, supervisor of track, Chesapeake & Ohio; R. Rossi, yard foreman, Alton; and H. E. Herington, section foreman, Minneapolis & St. Louis. There appears to be some confusion as to the proper terms to use in connection with guard rails. The passageway between the running rail and the guard rail is the flangeway. The distance between the wearing faces of the guard rail and the wing rail of the frog, 4 ft. 5 in., is the guard-face gage. Guard-rail gage is always the distance between the wearing face of the guard rail and the gage line of the frog.—Editor.]

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Ice Jams at Pile Trestles

Where ice jams occur at pile trestles, what damage is likely to occur to the structures? What action can be taken to prevent it ?

Damage May Be Very Great

By O. F. DALSTROM
Engineer of Bridges, Chicago & North Western, Chicago

As a preliminary, it should be stated that a timber pile trestle is not a suitable type of structure to install where ice movement is heavy or frequent. High water, swift current and heavy ice in combination occur every spring in some streams; less regularly in others. When they do occur, pile bridges that are in the way are likely to be wrecked or carried away completely. There are, however, many streams in which heavy ice seldom occurs, or if it does it goes out slowly before the high-water season. At such streams, pile bridges serve the purpose adequately, except on heavy traffic lines.

Assuming that it is desired to construct a line at low first cost, it will be necessary to resort to pile bridges wherever they fulfill the requirements of the waterway and the traffic. When the character and behavior of the stream are known, that type of bridge will be selected that best meets the conditions that may be expected. The effect of moving ice on the bridges will depend (1) on the volume of the ice and the size of the fragments, (2) the height and velocity of the water, (3) the direction of the current with reference to the bents and (4) the height and stability of the bridge. Having selected pile bridges for places where there will be ice movement, fender piles or other devices may be built into the structures or added to them to afford a limited amount of protection.

Ice not more than 2 to 3 in. thick can do appreciable damage to piles by impact and abrasion, and this at moderate velocity. Protection will be afforded by driving a single fender pile effectively braced to and in the line of the bent, to break up the ice and divide it so that it will pass along the two sides of the bent. A light section of T-rail attached on its upstream face and extending above the ice level will break the ice and protect the fender pile against being worn away. If the current is not parallel with the bents, the ice on the up-

stream side will be thrown against the bent after passing the fender pile. In this event, horizontal plank sheathing nailed along the bent on that side over the height subject to ice action will afford the necessary protection.

Pile bridges 20 ft. or more in height are likely to be thrown out of line by the unusual pressure if ice and debris become clogged in the bridge. Additional brace piles on the downstream side, set at a heavy batter and well braced to the bents, provide effective means of holding bridges against displacement.

Ice that attains a thickness of 4 to 6 in., and which moves out slowly, will reach the piles in large cakes. To break up such ice most effectively, a pile or heavy timber at the upstream end of the bent, sloped at an angle of 45 deg. with the horizontal, will break up the ice by lifting it as it advances. The ice breaks in two of its own weight and falls back into the water. Such a fender should be exceptionally strong and well protected with a T-rail or heavy angle on the upper side. This type of protection is most generally used to protect timber piers, a built-up timber frame covered with metal taking the place of the single stick which is used for protecting a bent.

An unobstructed waterway at the bridge, a straight channel extending 100 to 200 ft. upstream and a shorter distance downstream, short steel spans on double bents at points of concentrated flow and deflectors upstream from the bridge to hold the current to the established course, are all measures for minimizing the danger of ice jams that can be taken when the bridges are built. When the danger is foreseen, men and equipment for preventing or breaking the jam can be hurried to the site. Derricks for lifting out logs and trees that may be mixed with the ice, dynamite for blasting at strategic points and long cables attached to the drums of locomotive cranes set outside the danger zone are all part of the bridge supervisor's equipment for meeting the menace of ice jams.

Jams Most Severe in Wide, Shallow Streams

By G. M. HELMIG
Bridge and Building Department, Missouri Pacific, Wynne, Ark.

It has been my experience that ice jams occur most frequently and are likely to be most severe in wide shallow streams that are subject to sudden rises. Several cases of total destruction of trestles and several others of severe damage as a result of ice jams in such streams have come under my observation. Of all of the methods I have seen employed to minimize this damage, a triangular cluster of piles equipped with a wedge-shaped steel shoe seems to be most effective. This cluster should be located slightly up-stream and directly in line with the bent it is to protect.

Incline trestles which are used in connection with car ferries, can best be protected by means of a sheer boom. This consists of a row of piling, spaced about 50 yd. apart, parallel with the current but outside of the main channel. It should be located slightly above the incline so as not to interfere with the operation of the transfer boat. A second-hand cable should be strung slack between the piling and floated by means of old piling or heavy bridge timbers which are attached to it at properly-spaced intervals. The cable and attached timbers will act as a fender to deflect any ice floes which may come against them. This installation can be made in the late fall, and all of the material, except the driven piles, which should last several years, salvaged in the spring. Handled in this way, there is little expense involved in making the installation.

Pile Fenders Have Proved Effective

By L. G. BYRD
Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

Great damage to, and sometimes complete destruction of, pile trestles results from ice jams. This is especially true of those streams in which the velocity of the current is high. It has been my misfortune on more than one occasion to note this damage, such as breaking off and splitting piles, tearing braces loose from the bents, and shifting of the structure out of line. When trestles must be constructed in streams that are subject to ice jams, the pile bents should each be protected by a cluster of three additional piles driven on the upstream side, with a V-shaped frame to cover it and act as an ice breaker. The three piling should be well secured and braced with the timber fender by means of bolts.

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Insulating Floors

Should the floors of waiting rooms and offices in frame passenger stations be insulated? Why? If so, what is the best method of doing so ?

Floors Should Always Be Insulated

By A. T. HAWK
Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

It is scarcely open to argument that the floors of frame passenger stations should be insulated. In the past, it has been a common practice to install a sub-floor of 1-in. by 8-in. shiplap or 1-in. by 6-in. D. and M. lumber. Over this it has been the usual practice to place either rosin-sized building paper or No. 2 felt, a better practice being to use an asphalt-saturated felt. Finally, the finished floor has been laid with maple or grain-edge yellow pine.

Necessity for further insulation will depend on whether the outside foundation walls of the station are tight; in other words, whether they are constructed of stone, concrete or brick, or whether the building is supported on masonry piers or creosoted pile butts. If the building sets on piers or pile butts, it is necessary to have a greater amount of insulation than if it rests on a tight foundation. Usually, the spaces between piers or pile butts are boarded up or filled with a lattice, leaving ample space for the circulation of air beneath the floor to prevent dry rot.

It is good practice to use a minimum of ½ in. of insulating board between the two layers of flooring. It is highly desirable, however, to place waterproofing felt over the insulating board to prevent moisture from reaching the insulation as a result of the scrubbing of the floor. It is also essential to insure that the insulation is fitted as tightly as practicable against the outside of the sheathing boards to stop any air currents that might otherwise come through the floor joists and flow up between the studding.

Floor Insulation Pays Large Returns

By General Inspector of Buildings

From long observation, I am convinced that building insulation properly applied pays a much larger return on the investment than is generally realized. In fact, it will pay for itself in a relatively short time, after which it will continue to earn a profit during the remainder

of the service life of the structure. To obtain maximum results, however, it should be applied to all exposed surfaces, including exterior walls, roofs and floors.

In cold climates, insulation is applied primarily to reduce heat losses from the building, two results being sought, the comfort of the occupants and a reduction in the cost of heating. These objectives will be realized in proportion to the effectiveness of the installation. Much heat is lost through floors, particularly in buildings that do not have basements. For this reason, the value of floor insulation is materially increased where there is no basement and is greatest for buildings that rest on open foundations, such as masonry piers or pile butts.

In making an application of insulation to the floor of a frame passenger station, the sub-floor should be laid as usual and covered with a layer of building paper, well lapped. Next a layer of insulating board should be applied and this, in turn, should be covered with a layer of asphalt or tar-saturated felt, also well lapped, to prevent moisture from reaching the insulation when the floor is mopped or scrubbed. The flooring should then be laid.

Insulation, whether applied to a floor, a roof or a wall, should always be in addition to the structural members and never as a substitute for them. It is always more effective if used in conjunction with rosin-sized building paper, since the latter tends to shut off the currents of air which are so likely to find a channel through walls or floors on windy days. To insure the elimination of air leakage, extra care should be exercised at the junction of the floor with the exterior walls to block off any channels through which air currents might flow.

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Protecting Track Fastenings

What means can be employed to eliminate or minimize the corrosion of track fastenings which are exposed to brine drippings or other unusual corrosive conditions ?

Method Must Meet Two Requirements

By J. B. MARTIN

General Inspector of Track, New York Central, Cleveland, Ohio

It is well known that serious losses occur from the corrosion of rail as well as track fastenings as a result of brine drippings, industrial fumes and the elements. While these losses are difficult to estimate in dollars and cents, they are extensive enough to merit serious attention. Any method of combating this corrosion must meet two requirements—effectiveness and reasonable cost.

Two methods do this, and both can be used in combination to secure maximum results. They are the use of alloys to produce rust-resisting metals and the application of protective coatings. The use of copper-bearing steel or wrought iron in spikes, bolts, tie plates, etc., will not add greatly to the cost and will minimize the effect of corrosion, giving added life that will compensate many times for the added expense. Angle bars are now generally heat treated in oil, which makes them rust-resisting for some time.

Spray outfits can be employed for applying a protective coating of oil at a reasonable cost per mile of track. The oil should contain sufficient asphalt to give a substantial and durable coating. The spray should be so adjusted as to cover thoroughly the web and flanges of the rail as well as the fastenings. Applications should be frequent enough to maintain a film on the surface of the metal. There are certain points, such as at turnouts, interlockings and elsewhere, where hand applications to the affected parts are justified. Elsewhere, they should be made with a spraying car. Experience has demonstrated that these methods result in substantial reductions in the loss from corrosion, which more than offset the cost of the applications.

Oil Spray Is Most Effective

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

I know of only one method of minimizing the effect of the corrosive conditions enumerated, and that is the use of a good grade of oil, high in asphalt, that is prepared especially for this service. Ordinary oil is not suited to this service since it dries up and vanishes in a comparatively short time and must be renewed, for which reason the labor cost becomes excessive. To be satisfactory, the oil should adhere firmly to the metal surfaces, and be durable enough so that, beginning with the second application, it does not need to be renewed oftener than once a year. Such an oil will form a protective coating which will largely, if not entirely, eliminate the process of corrosion.

There is a space between the angle bar and the web of the rail that should be coated, but this cannot be done with a brush. For this reason, I favor the use of a spray for oiling track fastenings, as the spray will reach any spot that can be reached by the brine drippings. If the angle bars are protected on the outside only, a large area of surface next to the rail is still open to attack, and this can be reached only by spraying. A brush may put a heavy coat on the outside, but cannot reach some of the surfaces where it is most needed.

Corrosion-Resisting Metal Is Best

By THOMAS WALKER

Roadmaster, Louisville & Nashville, Evansville, Ind.

So far as track fastenings that are already in service are concerned, the only practicable method of minimizing the effect of the corrosive conditions enumerated seems to be that of coating them with paint or oil. This is laborious and expensive, however, and it is doubtful whether the cost is justified, except on certain roads or divisions where the damage is excessive. Bolts and angle bars should be oiled, however, wherever they are subjected to brine drippings. Coating with oil is not a positive cure, and must be done repeatedly to secure satisfactory results. In general, the first application on new fastenings is lost, as it simply loosens the mill scale, causing it to drop off during the first heavy rain and leaving the underlying metal free from oil.

Where fastenings suffer severely from the effects of brine drippings or other corrosive influences, they should be made of copper-bearing steel. Tests have demonstrated that steel containing a small percentage of copper has high resistance to the form of corrosion induced by brine drippings. My own experience indicates that the life of track spikes is doubled by the use of copper-bearing steel. On the other hand, wrought-iron tie plates are far more resistant to corrosion than steel plates, lasting as well, or even better, than copper-bearing steel plates.

Damage from brine drippings is generally confined to a zone outside of the rails, being most pronounced on the ends of the angle bars from which the brine cars

approach. The brine is thrown against this end and collects on the flange of the rail, eating a depression close to the end of the angle bar. The force with which it strikes also forces the brine between the splices and the rail, into the fishing surfaces and against the shank of the end bolts, where the damage may be severe. This can be minimized somewhat by plugging this space with pitch or mastic which will not slough or flow in hot weather.

As I see it, the true solution of this evil is to eliminate brine drippings. Much has been said and written on retaining tanks that can be emptied at terminals, but so far I have seen no lessening of the volume of drippings, and the damage to track fastenings seems to be as great as ever. As the cars are now constructed, the brine is deposited close to the rail. If it could be directed farther away, although bridges and turnouts would still be damaged to the same degree, the corrosion on mile after mile of track would be reduced.

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Kinked Rails

What causes rails in track to kink in surface? In line? What can be done to prevent this trouble? Can kinked rails be straightened and reused in main tracks ?

Damage Usually Caused by Locomotives

By G. M. O'ROURKE
District Engineer, Illinois Central, Chicago

One reason why rails become kinked in surface is neglected maintenance. If the joints are not kept picked up, whatever the reason, or the rail is not maintained to a true surface, kinks are sure to result. Rail that is improperly or insufficiently anchored will eventually become line kinked. Rail that is laid without proper regard for temperature variations is also subject to line kinks.

Intensive competition for traffic has resulted in the shortening of freight schedules and trains are sometimes pulled by locomotives designed for speeds far less than those at which they are now being run. An engine may operate for years on a district and cause no damage, but when operated at a higher speed than that for which it was designed may, in a single trip, damage a great number of rails, and cause a large expenditure for labor and relief rail. After such a trip a careful investigation, by tramming all parts, gaging tires, running the locomotive over a block to determine whether there is any binding in shoes and wedges and making a check of the counterbalance, may uncover nothing wrong. The logical conclusion then is that the locomotive was operated at too high a speed.

Sometimes these careful investigations result in finding irregularities, however, such as the so-called egg-shaped tire or that an internal structural failure is taking place in the tire. Owing to the peculiar contour of these defects, they are not easily detected by ordinary inspection, yet they cause rough riding and pounding and result in bent and broken rails.

After years of service, the running surface of rails becomes cold rolled and strain hardened. When bent by locomotives, the strain-hardened metal is put into compression. When the rail is straightened, the stresses are reversed and the tension thus introduced may exceed the yield point at the running surface. The result is that some rails break when an attempt is made to straighten them.

Rail manufacturers will not assume any responsibility for the future performance of rails that have been straightened and put back into the track. For this reason, such rails should be marked for identification and used only in secondary tracks.

Discusses Six Major Causes

By W. H. SPARKS
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

This is one of the troublesome problems confronting maintenance officers, and I am not sure that we have discovered all of the causes which contribute to this form of damage. So far as they have been determined, however, the responsibility seems to be two-fold. Furthermore, this damage, like most of that which occurs in other ways, is in large measure avoidable.

Mentioning the causes for which the maintenance department must assume full responsibility and listing them in the order in which they are most likely to occur, when rail is laid in track that is out of surface, it may become badly surface bent within a short time after installation. This is particularly true of rail laid in winter on a frozen roadbed. Obviously, the remedy for this is to put the track in reasonably good surface before the laying is started.

Failure to maintain a high standard of workmanship or neglect of important details while laying the rail may result in bent rails. Where adzing is done by hand, special supervision should be given to this operation to insure that every tie provides an even bearing for the tie plates and rails. Adzed surfaces that are not in the same plane for individual ties, that are out of level either transversely or longitudinally, or are too short, are quite likely to cause the rail to kink sooner or later. One of the best safeguards against this form of damage is the use of adzing machines.

Joints should be full bolted and the bolts tightened ahead of the gaging. Otherwise line kinks at the joints are quite likely. Similarly, standard gage should be maintained throughout the rail length. Uniform expansion should be provided and anti-creepers applied as soon as the spiking is completed. Insufficient expansion allowance or inadequate anchorage of the rail is almost certain to result in line kinks.

New rail should be surfaced as soon as laid, and the ties spaced. No matter how nearly perfect the surface was before the rail was laid, some inequalities of bearing will develop. If these are not eliminated, the chances for surface bending increase as the surfacing is deferred. This implies the cleaning of the ballast and the application of such new ballast as may be rendered necessary by the condition of the track.

No matter how carefully the rail may have been laid and cared for thereafter, it must be maintained properly or bending in surface and line are likely to follow. Ballast should be clean and in full section. Surface and line should be kept to a high standard. Bolts should be tight, anti-creepers in place and expansion uniform. Decayed or damaged ties should be removed as soon as they fail to support the rail. Neglect of any or all of these important items may have far-reaching results in rail damage.

If, after assuring ourselves that we have taken the foregoing precautions, we still find kinked rails we must seek elsewhere for the reasons for this damage. In this case it is generally found that the responsibility rests on other departments. Probably the most frequent of these causes is the operation of freight locomotives at speeds

in excess of those for which they are counterbalanced. Probably every maintenance officer has had some experience with this form of damage, so that it is unnecessary to discuss it further. The only remedy is to limit the speed to a point below that which results in the damage.

Another cause, not so frequent but of equally serious consequence, is flat or worn tires, particularly on locomotive driving wheels. Defects of this character have been known to result in broken rails, frogs, crossings and switch points, as well as a large number of kinked rails.

Can kinked rails be straightened and reused in main tracks? The answer is no. If the rail is suitable, it may be laid in yard or engine leads or other slow-speed tracks. If it requires straightening before it can be reused, it should be classified as scrap.

Defects in Maintenance Fertile Source

By R. ROSSI,
Yard Foreman, Alton, Glenn, Ill.

Nearly every defect in track maintenance is a potential cause for kinked rail — uneven surface, scant or fouled ballast, soft spots in the roadbed, disturbing the bed when renewing ties, wide gage, loose bolts, lack of expansion—any one of these may result in line or surface kinks. Obviously, the remedy is a higher standard of maintenance.

[Answers similar to those given above were received from the following: E. Lane, extra gang foreman, Missouri Pacific; W. R. Garrett, yard foreman, Chicago, Burlington & Quincy; and L. G. Byrd, bridge and building supervisor, Missouri Pacific. Mr. Byrd called attention to the fact that surface kinked rails are often found at the ends of open-deck bridges because the track has been allowed to get low on the approaches.—Editor.]

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Ice in Water Tanks

Where a heavy deposit of ice forms on the interior surface of a water tank, what effect does warm weather have? What means can be employed to overcome this trouble ?

Avoid Fluctuations in Water Level

By E. M. GRIME
Engineer Water Service, Northern Pacific, St. Paul, Minn.

Ice forms gradually on the interior surface of tanks and increases in thickness to as much as 12 to 30 in. in cold climates. This occurs more particularly where the supply is taken from a surface stream or reservoir at a temperature near the freezing point. If the supply is from a deep well, there is sometimes sufficient residual warmth to prevent the formation of thick ice, especially if withdrawals are frequent enough to keep the water stirred up.

With warm weather, the ice close to the interior surface melts and the ice cakes tend to break away and float on the surface of the water. Sometimes a ladder built close to the side of the tank becomes frozen solidly into the ice, and as the ice breaks away from the side, the tendency to float may be sufficient to tear the ladder from its fastenings and push it through the tank roof. In other cases the raising and lowering of the floating ice damages the tank valve and operating rods. This condition also makes it impracticable to use overflow piping extending to the water surface as it is almost impossible to prevent damage.

Wooden tanks heavily coated with interior ice frequently show more tendency toward leakage in the early spring than at any other time. Apparently the ice next to the tank surface melts first and as the water collects toward the bottom between the ice and the tank and freezes during the night, the expansion is sufficient to open the joints the small amount necessary to permit considerable leakage.

As it is usually impracticable to heat wayside tanks sufficiently to prevent the formation of considerable ice, the best way to avoid trouble when melting starts is to make a special effort to keep the tank practically full of water at all times, so that there will be a minimum fluctuation of the ice until it disappears.

Ice in Tanks Often Quite Troublesome

By C. R. KNOWLES
Superintendent Water Service, Illinois Central, Chicago

Ice in water tanks is often quite troublesome, particularly in standpipes. Generally little trouble occurs in ordinary wayside tanks if they are emptied and filled as often as once every 24 hr. During severe weather, however, a shell of ice will form around the inside of the tank, its thickness depending on the temperature of the water as it is pumped and the frequency with which the tank is filled and emptied. This shell is invariably thicker at the top where there is a fluctuation in the water line. Often, too, a thick sheet of ice will form over the top of the water in the tank.

Water pumped from wells is seldom below 45 deg., so that little trouble with ice is experienced in tanks where well water is used. Ice trouble is usually confined to points of surface supply, in which the water is pumped into the tank practically at freezing temperature. The principal difficulty in railway tanks arises from the fact that the heavy accumulation of ice falls as it thaws, causing damage to tank valves, float valves, ladders and riser pipes. That more trouble is not experienced is undoubtedly due to the fact that railway tanks are generally kept filled, thus minimizing the possibility of the ice falling any considerable distance.

Considerable trouble with ice was experienced in the earlier types of steel tanks, particularly those with cone bottoms from which the water was taken directly through a tank spout, the valve being located within the tank. If the water was allowed to get low, the ice would drop, damaging the valve. To overcome this trouble, it was necessary to install ice gratings.

Many failures have occurred in tall standpipes as a result of the formation of ice. The accumulation at the top often forms a seal and as the water is drawn from the tank a vacuum is created which has, in a number of instances, resulted in a collapse of the tank. One of the notable failures of this type occurred several years ago in a municipal tank at Elgin, Ill. This tank was 30 ft. in diameter, 95 ft. high and had a capacity of 500,000 gal. The main upper section of the standpipe contained several hundred tons of ice, and while it is not entirely clear as to just how the failure took place, it was preceded by a crash of falling ice and the plates composing the four lower rings were torn loose from the upper section and from the base of the tank. The upper 75 ft. of the standpipe fell free of the foundation. This example is given to indicate the importance of avoiding the formation of heavy ice if it is practicable to do so and of keeping the tank full of water in the event that it is not practicable.

News of the Month . . .

Construction Loans to Railroads

On February 21 the Southern Pacific filed a request with the Reconstruction Finance Corporation for a loan of $1,200,000 to be used for the construction of a station at Houston, Tex. This application must be approved by the Interstate Commerce Commission before the loan can be granted. The commission has approved a loan of $600,000 to the Meridian & Bigbee River from the R.F.C. for the construction of a line from Cromwell, Miss., to Myrtlewood, Ala.

Propose Pooling of Facilities

The joint use of certain rail facilities by the three northern transcontinental carriers for the purpose of effecting economics in operation is proposed in plans now under consideration by these lines. It is planned to pool the trackage of the Chicago, Milwaukee, St. Paul & Pacific through a large part of Montana to create a more direct joint short line. The routing of Northern Pacific passenger trains through the Union Station at Spokane, Wash., and the closing of the Northern Pacific station is also proposed. The Great Northern is involved in the studies as regards the joint use of some branch line facilities.

Pullman Excursions Create Business

The experiment of the Pullman Company in reducing sleeping car rates in conjunction with low rail rates has shown remarkable results during the 20 months in which the practice has been in effect. During this period, 350 excursions were operated, varying from 1 or 2 cars to 33, with an average of 170 passengers per excursion. Approximately 6,000 persons were carried in 2,171 cars, an average loading of 27.3 passengers per car. The additional revenue resulting from these operations was satisfactory, even at the reduced rates, and at the same time Pullman service was introduced to a large number of persons to whom it was a new experience.

State Body Denies Truck Permits

In a decision that is held to be of major importance, the Illinois Commerce Commission has refused to grant operating certificates as common carriers to two trucking companies in the state. The companies involved are the Keeshin Motor Express Company and the Interstate Trucking Company, which operate a total of 225 motor trucks. The commission instructed the attorney general of Illinois to obtain court orders at once to restrain the two companies from continuing their operations. In denying the applications the commission pointed out that the operations of these companies endanger the investments of the railways in transportation facilities and that the railroads, furnishing service to 22,875 communities in the state, deserve the protection of the regulatory body.

Transport Legislation Considered by Roosevelt

Plans for legislation to combine regulation of all forms of interstate transportation under a single federal bureau or commission, probably a reconstructed Interstate Commerce Commission with enlarged powers to deal with the various carriers now competing with the railroads, are now under consideration by President-elect Roosevelt as part of his program for the coming session of Congress. In his speech at Salt Lake City during his campaign Governor Roosevelt proposed a national policy for dealing with all forms of transportation, to include regulation by the Interstate Commerce Commission of competing motor carriers, and plans have been made by Democratic leaders in Congress for a rather extensive program of transportation legislation at the extra session.

North Western Establishes Casualty Rate of 1.99

The Chicago & North Western, which was awarded the National Safety Council's plaque for the best safety performance among employees in 1930 and which in 1931 also had the lowest casualty rate among the carriers in Group A, will again contend for the award, with a casualty rate of 1.99 for 1932. This rate compares with 1.59 for 1931. In 1932, 117 employees were killed and injured, as compared with 129 in 1931, while the man-hours worked totaled 58,902,000 in 1932 and 81,125,027 in 1931. Injuries to passengers were reduced from 64 to 36, only 2 of whom were hurt in train accidents and these were only slightly bruised. The number of persons killed in crossing accidents was reduced from 60 to 52 and the injured from 112 to 82, a total decrease of 38.

December Net Tops Year Ago

For December, 1932, the Class I railroads of the United States had a net railway operating income of $32,856,895, which was at the annual rate of return on their property investment of 2.01 per cent, as compared with a net income of $25,618,392, or 1.68 per cent, in December, 1931. Operating revenues for December amounted to $246,062,200, against $288,645,768 in December, 1931, a decrease of 14.8 per cent. Operating expenses in December totaled $188,205,333 as compared with $235,206,477 in the same month of the previous year. For the 12 months of 1932 these roads had a net railway operating income of $334,324,999, which was a return of 1.25 per cent, as compared with a net of $537,945,488, or 2 per cent, for 1931. Operating revenues in 1932 amounted to $3,161,928,659 as compared with $4,236,421,341 in 1931, a decrease of 25.4 per cent, while operating expenses decreased from $3,259,295,115 to $2,429,385,918, which was a drop of 25.5 per cent.

Milwaukee Has One Fatality in 15 Years

A record of 15 years with only one passenger fatally injured as a result of an accident involving its passenger trains was established by the Chicago, Milwaukee, St. Paul & Pacific upon the completion of 1932 with no passengers killed. During the 15 years more than 54,000,000 passengers have traveled on this railroad, their journeys totaling over 10,000,000,000 miles.

Recommends Abandonment of Federal Barge Service

The service of the Federal Barge Line on the Mississippi river and its tributaries, which is conducted by the government-owned Inland Waterways Corporation, "should be discontinued and liquidated by sale to private enterprise," according to a recommendation included in a report which has been submitted to the House of Representatives by the special committee which was appointed last May to investigate government competition with private enterprise. Representative Joseph B. Shannon is chairman of the committee. This was one of a series of 26 recommendations made by the committee, proposing the discontinuance of various forms of government activity which were called to its attention during the investigation.

"Coolidge" Committee Reports

A belief that the railroads must be preserved as the foundation of our system of communication was expressed in the report of the National Transportation (Coolidge) Committee, which was made public on February 15. In general the report is divided into five sections, considering in turn the present transportation setup, governmental rate-making policies, railroad self help, extension of regulations to include other forms of transport and the present emergency. Among the recommendations included in the report are the following: Railroad regulation should be concentrated upon the protection of public interest and should not attempt to "run the business" of transportation; regional consolidations should be hastened looking eventually to a single national system; railroads should be permitted to own and operate other forms of transport, including water lines; inland waterways should bear all cost of the facilities provided for navigation; automotive transport should be put under such regulation as is necessary for public protection; and the Interstate Commerce Commission should be reorganized throughout.

Association News

American Railway Bridge & Building Association

Members of the association who will be in attendance at the A. R. E. A. convention in Chicago on March 14 will gather in the dining room of the Davis Store for luncheon at 12:15. At the conclusion of the luncheon, the Executive Committee will meet at the Palmer House to discuss those activities of the association that should be continued, pending the next convention.

Maintenance of Way Club of Chicago

George M. O'Rourke, district engineer of the Illinois Central, Chicago, spoke at a meeting on Wednesday evening, February 15 on Programming Maintenance of Way Work. The speaker at the next meeting, which will be held on Wednesday evening, March 22, will be V. R. Walling, principal assistant engineer of the Chicago & Western Indiana, who will talk on "Current Trends in Highway Crossing Construction."

N. R. A. A. Annual Meeting

The annual meeting of the National Railway Appliances Association will be held in the offices of the association, 910 South Michigan Avenue, Chicago, at 11 o'clock on the morning of Monday, March 13, to elect officers for the ensuing year and to transact any other business that may come before the meeting. This meeting is held at this time by reason of the fact of the annual exhibit, which is customarily presented at the Coliseum during the convention of the American Railway Engineering Association, has been postponed for this year.

American Wood-Preservers' Association

The newly-elected officers and members of the Executive Committee met at the Hotel Sherman on the afternoon of January 26, following the conclusion of the convention, to organize the work for the new year. After approving the budget for the association and in accordance with a newly-adopted revision of the constitution, H. L. Dawson, secretary of the association, was re-appointed to this position for another year. Detailed consideration was given to the organization of the technical committees for the new year, subjects being selected and the personnel appointed. The chairmen of these committees, most of whom were re-appointed from the previous year, met with the Executive Committee at dinner, at which time opportunity was afforded for detailed discussion of the work of each of the committees.

It is expected that an informal meeting will be held of those members of the Executive Committee who are in attendance at the A. R. E. A. convention on Wednesday, March 15.

American Railway Engineering Association

The thirty-fourth annual convention will be held at the Palmer House, Chicago, as in recent years and, as was the case in 1931 and 1932, the meeting will be limited to two days—March 14 and 15. As noted in the program given below, there will be five sessions, including a session on Tuesday evening for the presentation of the reports of the Committee on Stresses in Track and the Committee on Rail. These will be featured by illustrated talks, the former committee being represented by its chairman, Dr. A. N. Talbot, and the latter by Professor H. F. Moore of the University of Illinois, who is conducting the rail research program of the American Railway Association and the rail manufacturers. The report of the Committee on Maintenance of Way Work Equipment, which will be presented Tuesday afternoon, will be supplemented by a talking motion picture.

As at the last two conventions there will be a luncheon for members of the A. R. E. A. and the National Railway Appliances Association and guests on Wednesday noon, to be followed by an address by F. E. Williamson, president of the New York Central. The program follows:

Tuesday Morning

President's address, John V. Neubert, chief engineer maintenance of way, New York Central.

Reports of secretary and treasurer.

Reports of committees on:

- Uniform General Contract Forms
- Wooden Bridges and Trestles
- Iron and Steel Structures
- Clearances
- Electricity
- Signals and Interlocking

Tuesday Afternoon

- Yards and Terminals
- Shops and Locomotive Terminals
- Records and Accounts
- Waterproofing Railway Structures
- Standardization
- Maintenance of Way Work Equipment

Tuesday Evening

- Stresses in Railroad Track
- Rail

Wednesday Morning

- Roadway
- Ballast
- Track
- Ties
- Wood Preservation
- Rules and Organization

Wednesday Afternoon

- Economics of Railway Operation
- Economics of Railway Labor
- Water Service and Sanitation
- Buildings
- Masonry
- Grade Crossings

Personal Mention

General

Henry A. Stahl, assistant treasurer of the New York Central and formerly assistant chief engineer of the Chicago Great Western, retired under the pension rules of this company on February 1.

George D. Brooke, vice-president and general manager of the Chesapeake & Ohio, with headquarters at Richmond, Va., and formerly a division engineer on this road, has relinquished the title of general manager and has been named also vice-president of the New York, Chicago & St. Louis (the Nickel Plate).

A. J. Witchel, chief engineer of the Spokane, Portland & Seattle, with headquarters at Portland, Ore., has been appointed assistant superintendent and secretary, and the position of chief engineer has been abolished. Mr. Witchel's appointment follows the announcement by the Great Northern and the Northern Pacific, owners of the S. P. & S., of a plan for joint operation of the subsidiary company by the parent companies.

R. L. Pearson, general manager of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., and formerly chief engineer of this road, has been elected vice-president with jurisdiction over the operating, engineering and construction departments. Mr. Pearson

R. L. Pearson

was born on April 2, 1882, at Philadelphia, Pa. He was educated at Swarthmore College and entered railway service in June, 1903, as a transitman for the American Railways Company. He entered the service of the New Haven in 1904, as an inspector in the construction department and served subsequently as a transitman, assistant engineer, track supervisor and division engineer. From October, 1917, to September, 1918, Mr. Pearson was with the U. S. Shipbuilding Company at Hog Island, returning to the New Haven on the latter date as division engineer, also serving in the same capacity on the Central New England. He

was appointed maintenance engineer for these two roads in 1921, and in 1923 he was advanced to engineer maintenance of way, holding that post until October, 1929, when he was promoted to chief engineer. In January, 1931, he became assistant general manager and in the latter part of that year he was appointed general manager, the position he held until his recent appointment.

W. C. Baisinger, assistant superintendent of the Oklahoma division of the Atchison, Topeka & Santa Fe, with headquarters at Arkansas City, Kan., and formerly a district engineer on this road, has been promoted to superintendent of this division, with the same headquarters. He was born on November 8, 1885, at

W. C. Baisinger

Eaton, Ind., and graduated from Purdue University. He first entered the service of the Santa Fe in 1907, as a masonry inspector at Galesburg, Ill., and after serving in various positions in the engineering department he was appointed division engineer of the Southern Kansas division at Chanute, Kan., in March, 1913. Two years later he was transferred to the Missouri division at Marceline, Mo., and in March, 1917, he was sent to Chicago as an assistant engineer. In November of the same year, Mr. Baisinger was promoted to office engineer at Chicago, being appointed roadmaster on the Eastern division at Ottawa Jct., Kan., two years later. From November, 1922, until April, 1923, he served as district engineer of the Eastern district of the Eastern lines, with headquarters at Topeka, Kan., and on the latter date he was transferred to the operating department as assistant superintendent of the Oklahoma division, at Arkansas City. Mr. Baisinger held the latter position until his recent promotion to superintendent, effective February 1.

Engineering

J. L. Doupe, chief surveyor on the Canadian Pacific, with headquarters at Winnipeg, Man., has retired after 43 years service with this company, and the position of chief surveyor has been abolished.

D. Hillman, engineer of construction of the Canadian Pacific, has been appointed district engineer of the Quebec district, with headquarters as before at Montreal, Que., to succeed **J. E. Beatty,** who has been appointed engineer maintenance of way of the Eastern Lines, to succeed **Allan C. MacKenzie,** whose death was noted in the February issue.

Carl F. Thomas, principal assistant engineer of the Spokane, Portland & Seattle, with headquarters at Portland, Ore., has been appointed assistant engineer, in which position he will be the ranking engineering officer of the S. P. & S. under the plan of the Northern Pacific and the Great Northern, joint owners of the line, for operating the S. P. & S. through their respective managements. The position of principal assistant engineer has been abolished.

R. J. Middleton, assistant chief engineer of the Western Lines of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Seattle, Wash., has been appointed to the newly-created position of assistant chief engineer of the system, with headquarters at Chicago. **A. G. Holt,** assistant chief engineer of the Eastern Lines has been appointed to the newly-created position of assistant to chief engineer, with headquarters as before at Chicago. The position of assistant chief engineer of the Eastern and Western Lines have been abolished.

Otto Gersbach, chief engineer of the Chicago River & Indiana and the Indiana Harbor Belt (both units of the New York Central Lines), with headquarters at Chicago, has had his jurisdiction extended to include the Western division of the New York Central and the West division of the Michigan Central. **F. J. Jerome,** division engineer of the Western division of the New York Central, at Chicago, has had his jurisdiction extended to include the West division of the Michigan Central, the Chicago River & Indiana and the Indiana Harbor Belt and will have charge of maintenance in these territories.

F. O. Condon, principal assistant engineer on the Atlantic region of the Canadian National, with headquarters at Moncton, N. B., has had his title changed to office engineer, and the position of principal assistant engineer has been abolished. **A. S. Gunn,** construction engineer on the Atlantic region, with headquarters at Moncton, N. B., has been appointed engineer right of way, with the same headquarters, to succeed **E. G. Evans,** whose retirement was noted in the December, 1932, issue. **L. H. Robinson,** assistant engineer, maintenance of way, with headquarters at Moncton, has been appointed division engineer, with headquarters at Halifax, N. S., succeeding **Alexander Scott,** who has been transferred to Charlottetown, P. E. I.

E. B. Fithian, division engineer of the Wichita division of the Missouri Pacific, with headquarters at Wichita, Kan., has had his jurisdiction extended to include the Joplin-White River divisions, and **J. H. McFadden,** division engineer of these divisions, at Nevada, Mo., has been transferred to the Omaha-Northern Kansas division, with headquarters at Falls City, Neb., succeeding **R. G. Bush,** who has been assigned to other duties. **J. R. Nagel,** division engineer of the Missouri and St. Louis Terminal divisions, at St. Louis, Mo., has been transferred to the Eastern division, at Jefferson City, Mo., where he replaces **A. P. Morrison,** who has retired. **C. E. Cherry,** division engineer of the Illinois division, at St. Louis, has had his jurisdiction extended to include the St. Louis Terminal division, and **A. B. Chaney,** division engineer of the Memphis division at Wynne, Ark., has had his jurisdiction extended to include the Missouri division, and hereafter will have headquarters at Poplar Bluff, Mo.

T. H. Strate, engineer of track elevation of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed division engineer of the Chicago Terminal division and the Terre Haute division, with headquarters as before at Chicago, and the position of engineer of track elevation has been abolished. **H. Wuerth,** division engineer of the Chicago Terminal division, has been transferred to the Iowa & Dakota division, with headquarters at Mason City, Iowa, where he succeeds **M. A. Bost,** who has been assigned to other duties. **E. H. Pfafflin,** division engineer of the Terre Haute division, with headquarters at Terre Haute, Ind., has also been assigned to other duties. **E. H. Johnson,** division engineer of the Iowa & Southern Minnesota division, with headquarters at Austin, Minn., has been transferred to the Dubuque & Illinois and the Kansas City divisions. with headquarters at Savanna, Ill., where he succeeds **R. A. Whiteford,** who has been assigned to other duties. The position of division engineer at Austin has been abolished and **A. Daniels,** division engineer of the Twin City Terminal and River divisions, with headquarters at Minneapolis, Minn., now has jurisdiction over the Twin City Terminal division and the Iowa & Southern Minnesota division. **W. H. Vosburg,** division engineer of the La Crosse division, with headquarters at La Crosse, Wis., has had his jurisdiction extended to include the River division.

Track

C. S. Ward, supervisor of track on the Kentucky division of the Illinois Central, has had his headquarters moved from Princeton, Ky., to Henderson.

Following the centralization in one officer of maintenance supervision in the Chicago Terminal district of the New York Central Lines, **G. G. Austin,** general roadmaster of the Chicago River & Indiana, with headquarters at Chicago and **C. T. Kimbrough,** general roadmaster of the Indiana Harbor Belt, with headquarters at Calumet City, Ind., have had their titles changed to supervisor of track. **C. L. Nolan,** supervisor of track on the New York Central at Chicago, has been appointed assistant supervisor of track with the same headquarters.

A. M. Hendrickson, roadmaster on the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn., has had his territory extended to include the Western Avenue yard at St. Paul. **C.**

An Official in Charge of Maintenance of Way on an Important Railroad Was Asked Recently Why He Preferred

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HIS REPLY WAS AS FOLLOWS:

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After seven years of test and service records of various anchors we have decided that the Woodings Anchor gives the best answer to all these requirements for the least cost."

WOODINGS FORGE AND TOOL COMPANY
VERONA, PENNA.

Lundquist, roadmaster with headquarters at Mankato, Minn., has had his territory revised to extend from Western Avenue, St. Paul, to and including Bingham Lake, Minn., as well as the Currie, Elmore and Fairmont lines. **A. Daugherty,** roadmaster at Worthington, Minn., has had his territory revised to extend from Bingham Lake, Minn., to LeMars, Iowa, including the Pipestone, Sioux Falls and Doon lines.

J. A. Schwab, supervisor on the Williamsport division of the Pennsylvania, with headquarters at Williamsport, Pa., has been transferred to the office of the chief engineer at Philadelphia, Pa., and **J. L. Cranwell,** assistant supervisor on the Philadelphia division, has been appointed acting supervisor to succeed Mr. Schwab. **J. D. Morris,** supervisor on the Williamsport division at Lock Haven, Pa., has been appointed acting supervisor on the Middle division, with headquarters at Tyrone, Pa., to succeed **P. E. Fuecht,** who has been appointed supervisor of motor service. **G. M. Hain,** assistant supervisor on the Middle division, has been appointed acting supervisor on the Williamsport division, with headquarters at Lock Haven to succeed Mr. Morris. **M. C. Fox,** general foreman of the welding train, has been appointed acting assistant supervisor on the Middle division, at Newport, Pa.

Bridge and Building

R. G. Schultz, a member of the engineering department of the Houston division of the Southern Pacific Lines in Texas and Louisiana, has been appointed inspector of bridges and buildings, with headquarters as before at Houston, Tex., to succeed **E. L. Hawkins,** whose death was noted in the January issue.

Obituary

B. V. Davis, division engineer of the Chicago division of the Chesapeake & Ohio, with headquarters at Peru, Ind., died on January 27, after a brief illness. Mr. Davis was born at Barboursville, W. Va., on April 16, 1880, and entered the service of the Erie in 1902 as a rodman on the Logan division. Subsequently he served as an instrumentman, resident engineer, supervisor of track, and as division engineer of the Cincinnati division. On February 1, 1925, he was transferred to the Chicago division, where he remained until his death.

Allan C. MacKenzie, engineer maintenance of way of the Eastern Lines of the Canadian Pacific, who died suddenly on January 24, as noted in the February issue, was born on April 19, 1881, at Inverness, Scotland. He came to Canada in 1903 and entered the service of the engineering department of the Canadian Pacific, serving successively as a draftsman in the chief engineer's office, resident engineer on construction and division engineer on maintenance. In 1912 he was appointed engineer maintenance of way of the Eastern Lines, the position he held until his death.

Andrew J. Neafie, principal assistant engineer of the Delaware, Lackawanna and Western, with headquarters at Hoboken, N. J., died at his home in Mountain Lakes, N. J., on February 11 at the age of 67. The death of Mr. Neafie brought to a close a period of practically 53 years of continuous service in the maintenance of way department of the Lackawanna. Mr. Neafie was born on November 24, 1865, at Port Coldon, N. J., and received his education in the public schools of Boonton, N. J., and through a series of correspondence courses. He entered railway service in 1879, as a relief man in the maintenance of way stores department of the Lackawanna. On April 1, 1882, he became a steam shovel fireman, and shortly thereafter he became a craneman and then a steam shovel engineer. After brief service in these positions, he became a locomotive fireman. Some time later he was appointed assistant to his father, James Neafie, who was superintendent of track on the Morris and Essex division. He continued in this capacity until 1899, when he was appointed division roadmaster on the Morris and Essex division. Shortly after this promotion he

Andrew J. Neafie

was appointed general roadmaster of the entire road, and then, in 1903, was promoted to the position of principal assistant engineer, which position he held until the time of his death. In this latter capacity, Mr. Neafie was in general charge of all track maintenance, including wrecking work and supervision over the road's frog and switch shop and timber treating plant, and, in addition, he had supervision over, the construction of all new tracks or track changes in connection with the extensive grade crossing elimination and grade and line revision work which the Lackawanna has carried out at many points. While performing his many routine duties, which resulted in a continual improvement in the standard of maintenance on the Lakawanna, Mr. Neafie was interested constantly in a wide scope of development work to improve maintenance materials and methods of performing maintenance work. He contributed largely toward the development of a number of maintenance of way devices, and was the inventor of the Neafie rail joint, and the Neafie oil spraying car.

Supply Trade News

General

The Canadian Concrete Products Company, Ltd., which is affiliated with the **Massey Concrete Products Corporation,** Chicago, has moved its office from Montreal, Que., to Belleville, Ont.

The Timken Steel & Tube Company, Canton, Ohio, has appointed **Delaware Steel Service, Inc.,** as its exclusive representative in the Philadelphia, Pa., district. The latter company is comprised of **Gustaf Peterson,** formerly with the Ludlum Steel Company, and **G. F. Wilson,** formerly with the Associated Alloy Steel Company, with whom is associated **Stuart B. Mathews,** who formerly was also connected with the Ludlum Steel Company.

Trade Publications

Caterpillar Twenty Tractor.—The Caterpillar Tractor Company, Peoria, Ill., has issued a new 40-page booklet describing and illustrating its Model 20 tractor. The booklet is profusely illustrated and attractively printed.

Inland Steel Sheet Piling.—The Inland Steel Company, Chicago, has issued a folder descriptive of the various sections, tees, corners, crosses and splices of Inland Steel sheet piling. The folder, which contains five pages, is illustrated with drawings and half-tones.

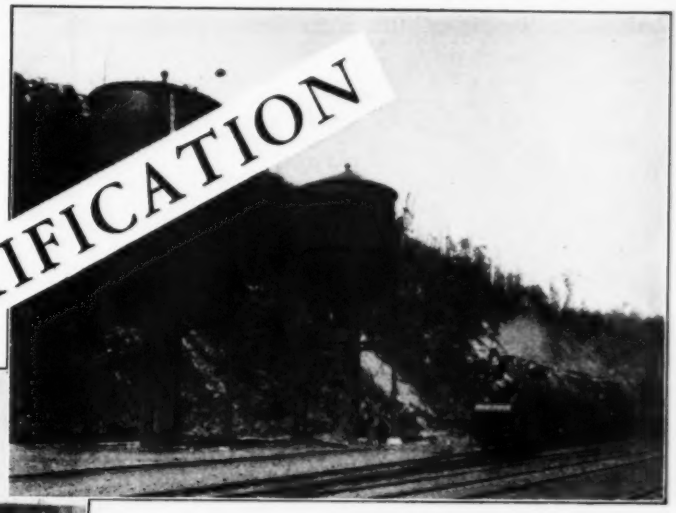
Pipe for Water Wells.—A six-page folder entitled "The Ideal Pipe for Water Wells," which sets forth the advantages of using Republic electric weld pipe for drilling water wells, has been published by the Republic Steel Corporation, Youngstown, Ohio.

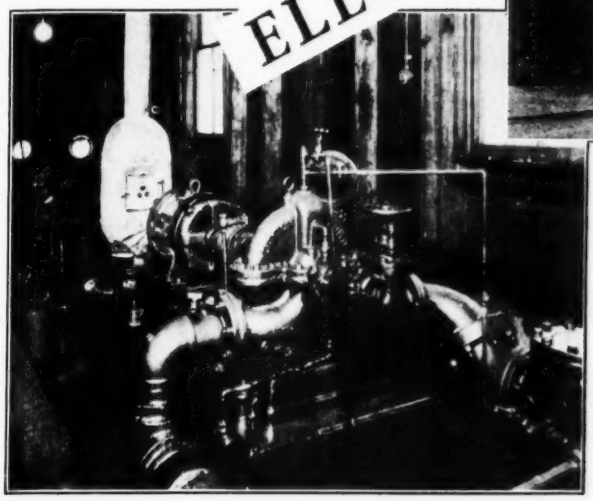
Cletrac Model 80 Tractor.—The Cleveland Tractor Company, Cleveland, Ohio, has published two folders devoted to its Model 80 tractor, one of which describes the various mechanical features of this unit while the other depicts a number of the uses to which it is adapted.

Armco Multi-Plate.—The Armco Culvert Manufacturers Association, Middletown, Ohio, has issued a 32-page booket containing complete information concerning this company's Multi-Plate pipe and Multi-Plate arches, including the advantages of use, the various uses to which these plates are adapted in providing drainage structures and directions for erection.

Truscon Steel Liner Plates.—The Truscon Steel Company, Youngstown, Ohio, has published a 28-page booklet which contains engineering data, standard contours, methods of increasing the section modulus, and properties of the various elements of the steel liner plates manufactured by this company. A considerable portion of the booklet is devoted to a pictorial description of projects in which these plates have been used successfully.

WATER SERVICE ELECTRIFICATION



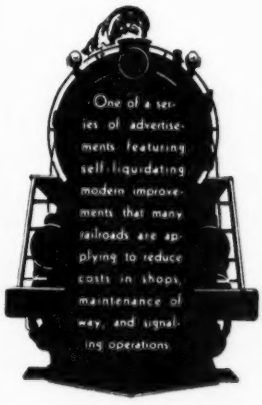


Interior of wayside pumping station. The two 300-gallon per minute centrifugal pumps are each driven by 15-hp. Westinghouse Motors.

REDUCES

Pumping Costs

50%



IN order to secure water of more satisfactory quality, a large Mid-Western railroad after a study of its water service facilities, developed an electrified pumping system located four miles from its tracks.

As a result of electrification, the cost of pumping water is now less than half of that for the plant previously in service near its tracks . . . and the quality of water is so far superior that the old treating plant has been abandoned.

This pumping station requires no attention other than a fortnightly inspection. It is entirely automatic.

Modern automatic electrical equipment permits the development and economical operation of plants at the sources of the most desirable water. Electrification also eliminates costly fuel deliveries. This is one of the most worthwhile opportunities that modernization offers to railroads today for reducing operating costs.

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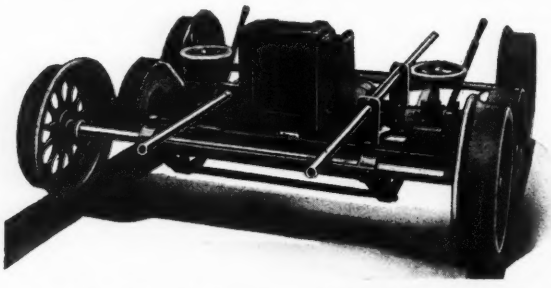

Railway Track-work Company Portable Track Grinder, Model P-2
Two grinding heads, operating independently, one on each rail. Electric motor driven. Grinding wheel operates at 900 surface ft. per min., feed regulated by hand wheel. Grinds gauge line or outside of rail. Derailing rollers raise grinder clear of track. P-4 same as above except operated by gasoline engine.

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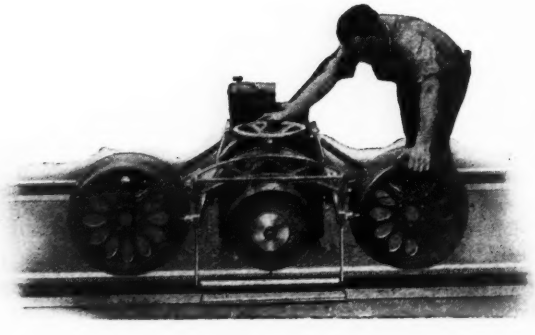

Railway Track-work Company Portable Track Grinder, Model P-3
Grinding wheel operates on either rail. Single throw hand lever operates a jack enabling operator to swing machine for grinding opposite rail. Grinds gauge line or outside of rail at 9500 surface ft. per min. Electric motor driven. Quickly adjusted roller permits speedy derailing. Model P-6 same as above except that it is operated by a gasoline engine.

1883

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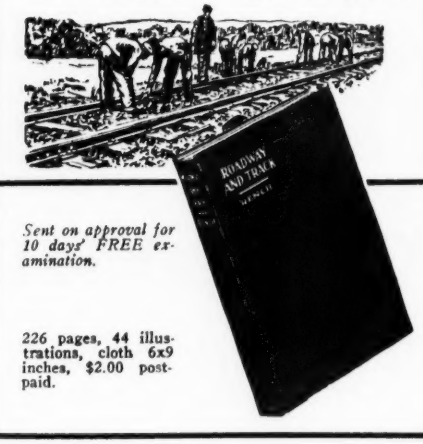

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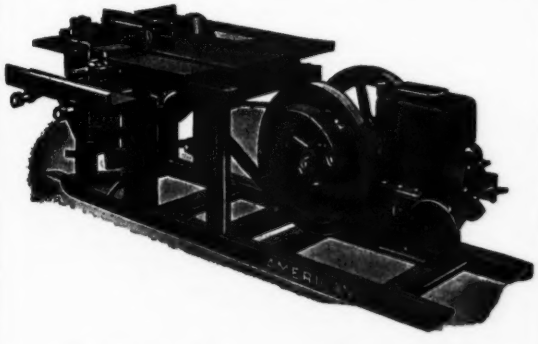

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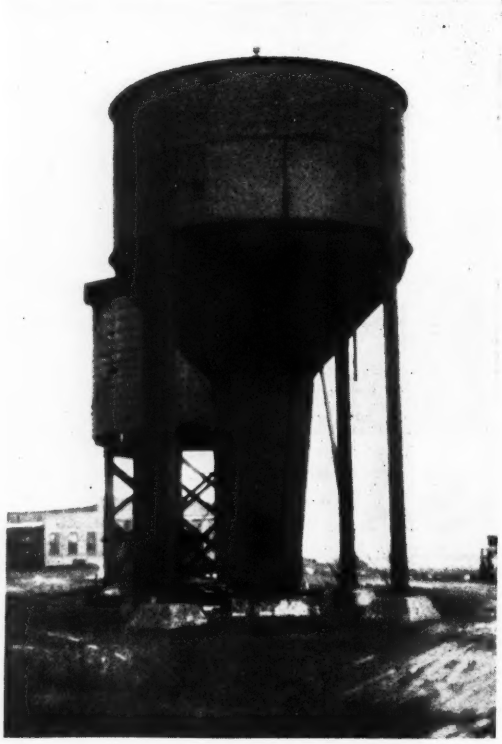

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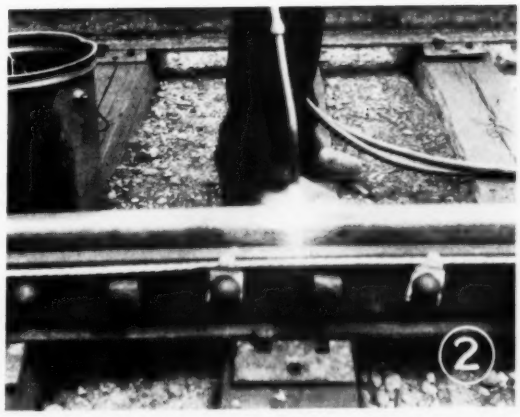

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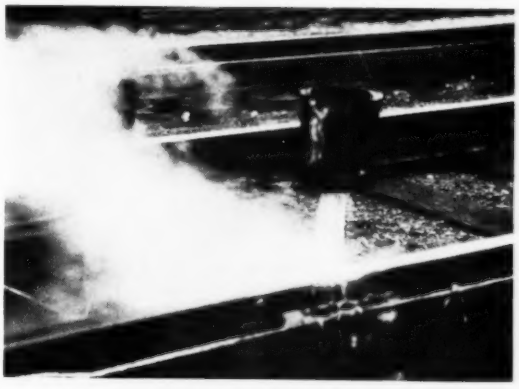

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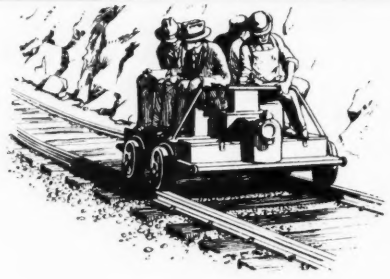
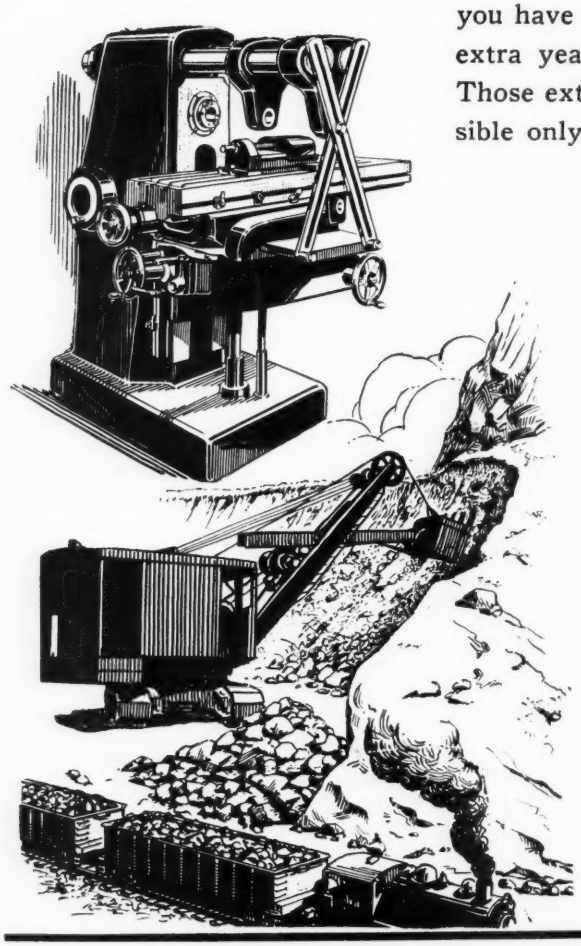
Tapered Roller
TIMKEN BEARING
EQUIPPED

For Lower Maintenance Costs





WHEN in doubt about which make of equipment to buy—whether you are in the market for a section car, or a power shovel or a machine tool—you can make a wise decision by studying the bearing equipment.

If you find Timken Bearings at the important points, you have definite assurance that you are buying many extra years of dependable, economical machine-life. Those extra years of trouble-free service are made possible only by the exclusive Timken combination of...

1—Tapered construction, with its ability to carry both thrust and radial loads;

2—Positively aligned rolls, which keep the bearing at maximum efficiency constantly;

3—Precision assured by a factory where millions of dollars are invested in the most accurate gauges and machinery known to modern manufacturing science;

4—Timken-made, special alloy steel, the most enduring material ever developed for anti-friction bearings.

"Timken Bearing Equipped" is one of the most important points to look for in buying any type of railway maintenance equipment. It means lower operating cost and longer life not only for the bearings but for the whole machine. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN *Tapered Roller* **BEARINGS**

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